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(54) **HELMET REINFORCEMENT SYSTEM**

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A42B 1/06 (2006.01)
A63B 71/10 (2006.01)

(52) **U.S. Cl.** **2/410**; 2/7; 2/171.3

(58) **Field of Classification Search** 2/410, 2/7, 411, 412, 425, 171.3, 184.5
See application file for complete search history.

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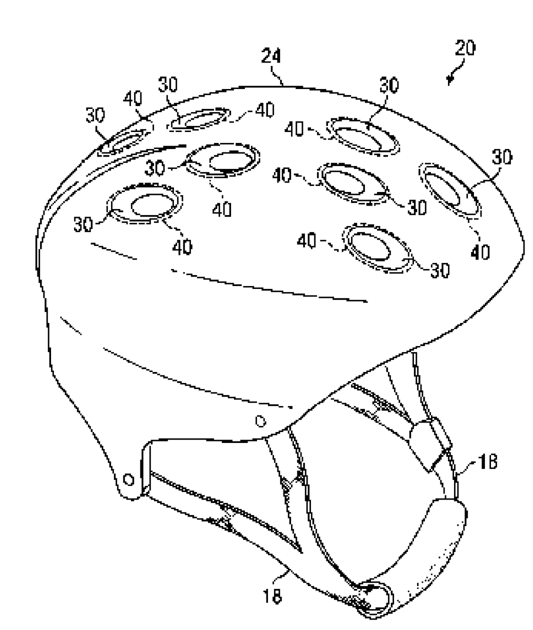
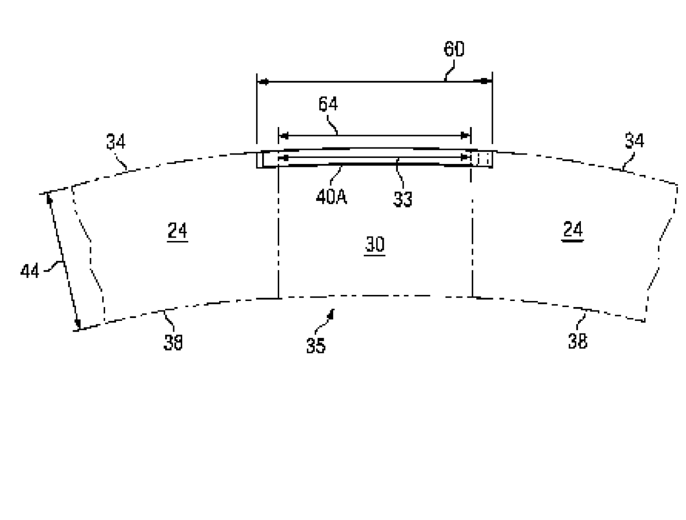
(74) *Attorney, Agent, or Firm*—Baker Botts L.L.P.

(57) **ABSTRACT**

According to one embodiment of the invention, a system for head protection is provided. The system includes a helmet body defining at least one hole. The system also includes at least one reinforcement member coupled to the helmet body. The reinforcement member defines an aperture that at least partially aligns with the hole of the helmet body.

30 Claims, 9 Drawing Sheets





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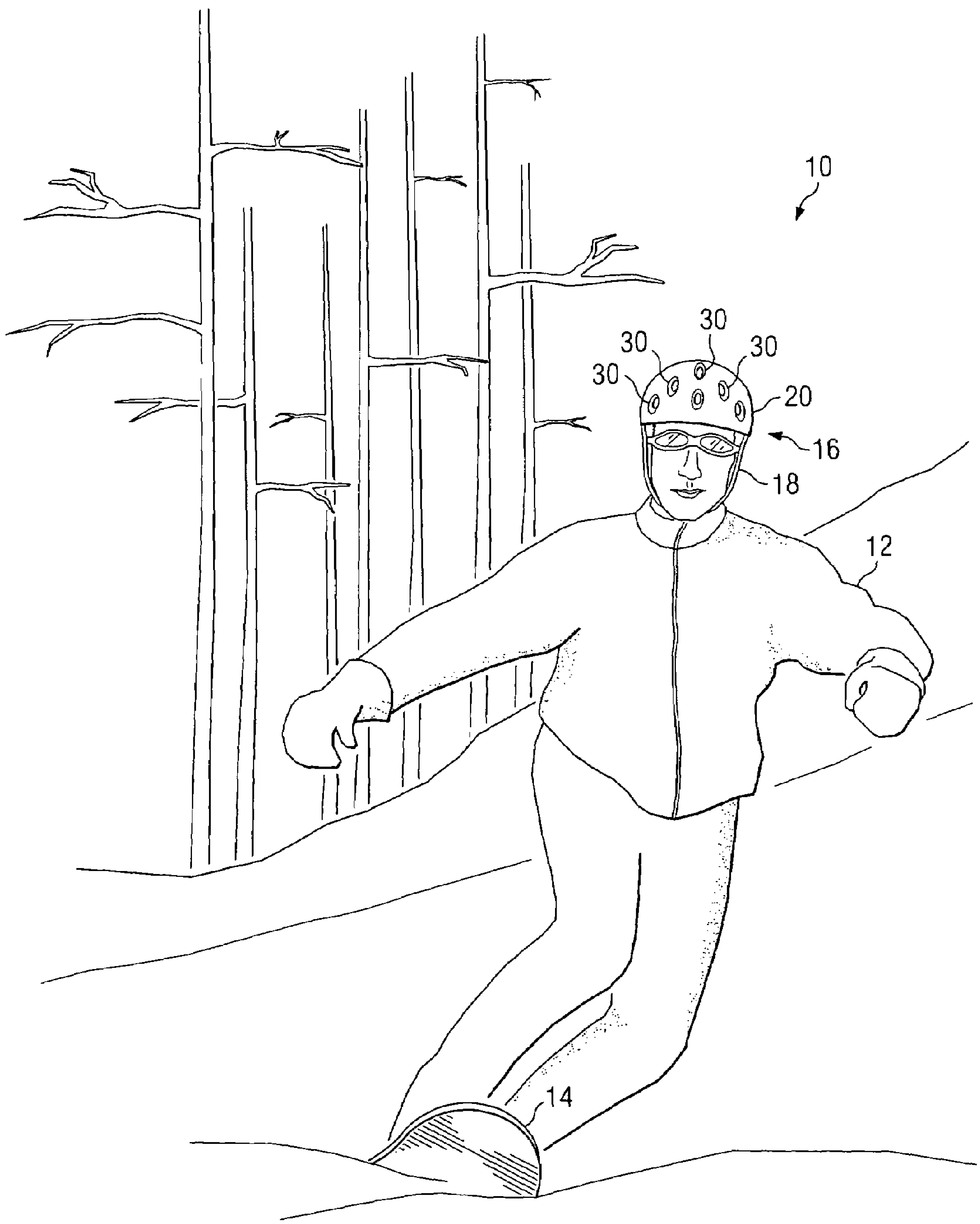

FIG. 1

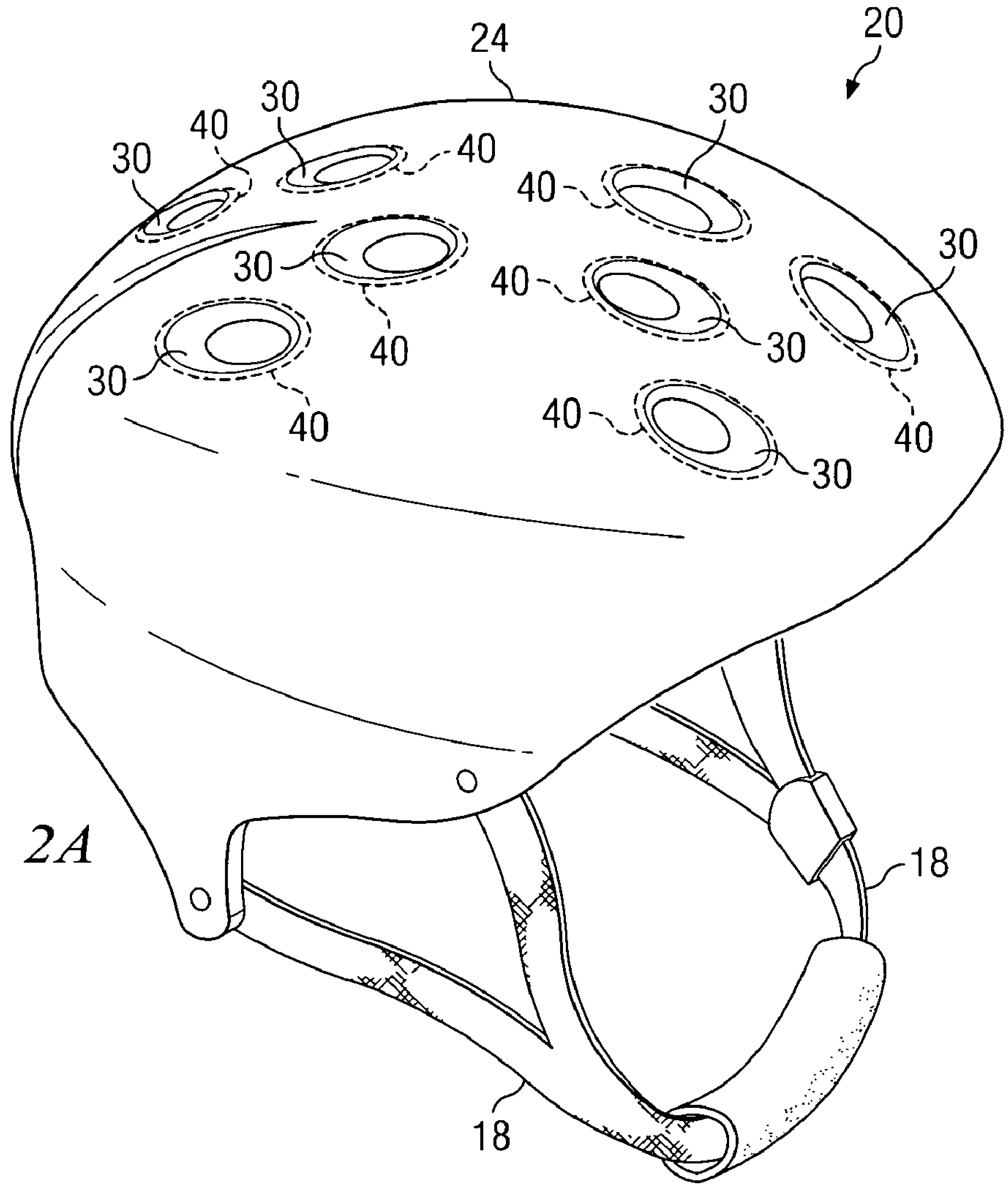

FIG. 2A

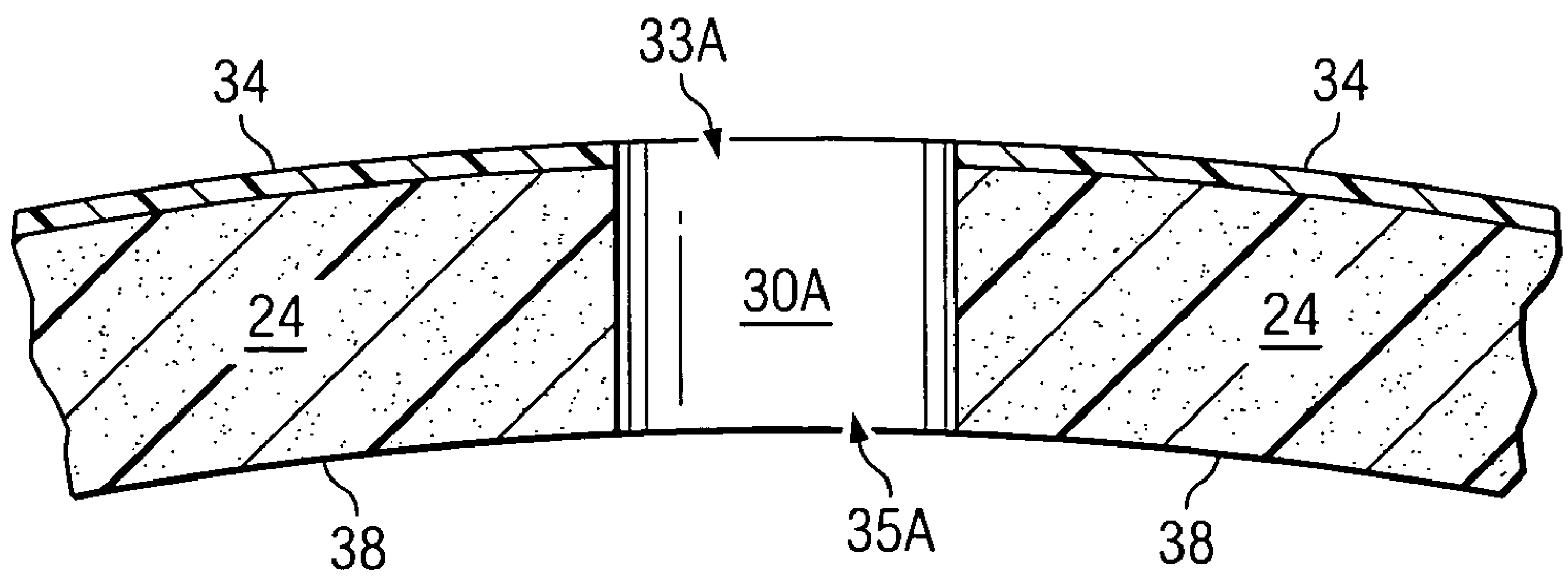

FIG. 2B

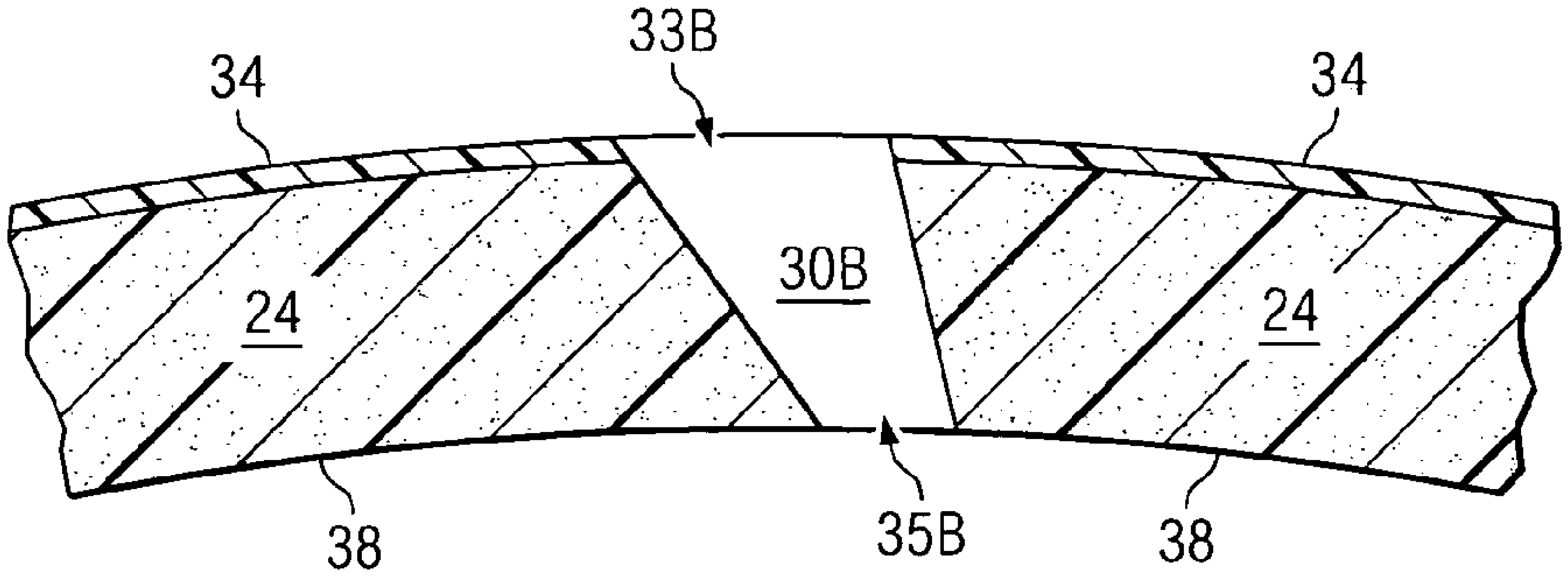

FIG. 2C

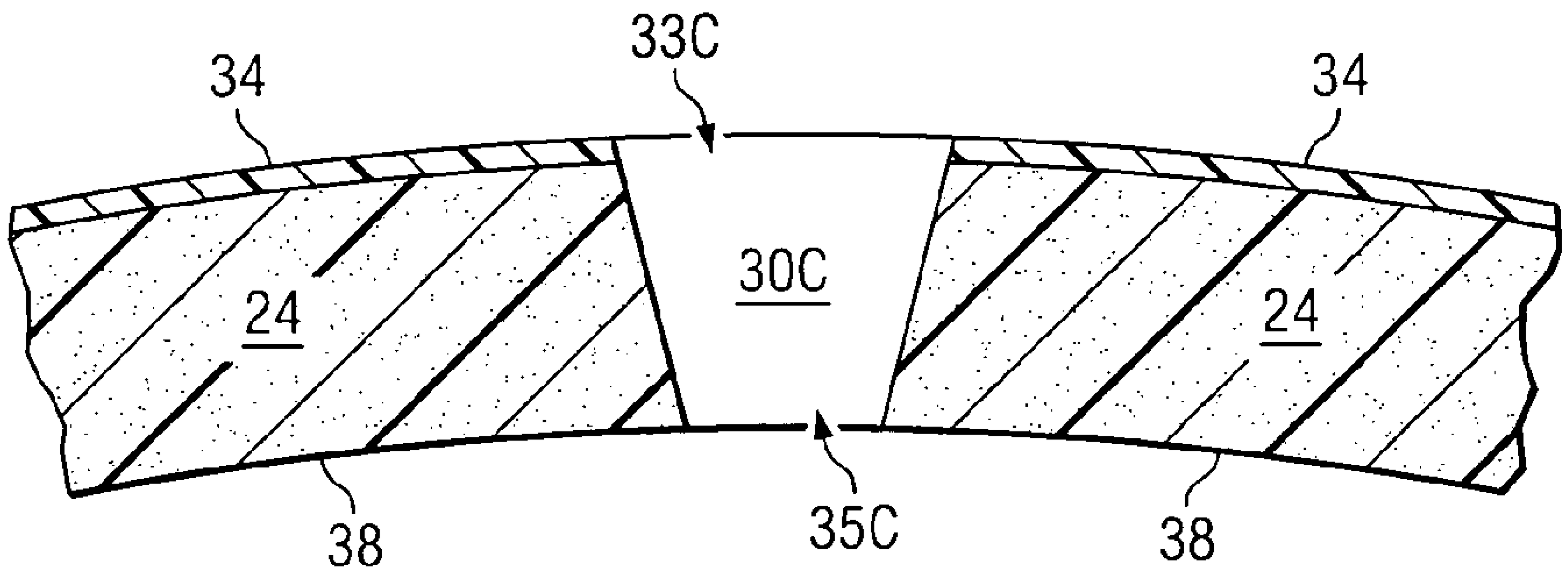

FIG. 2D

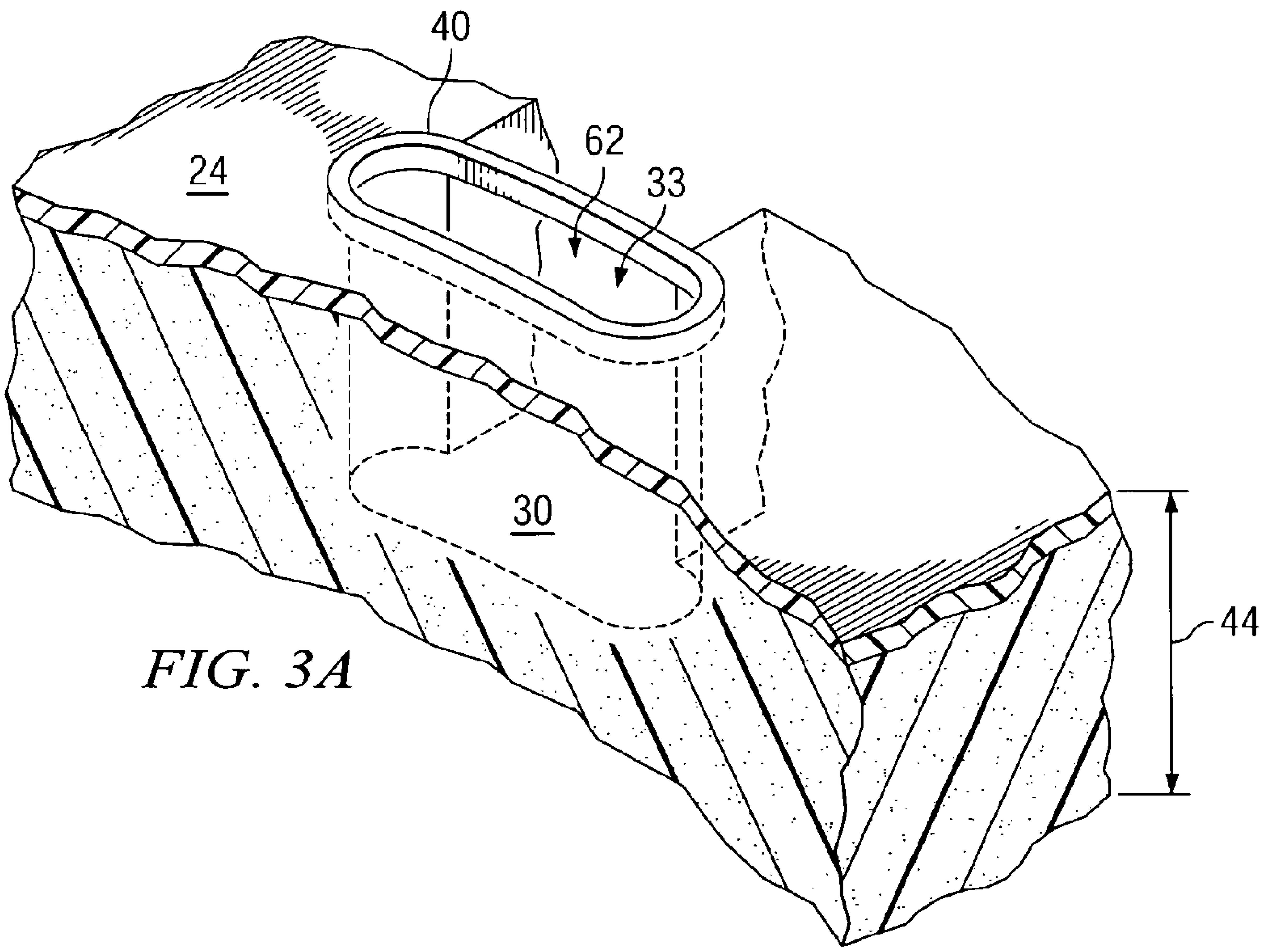

FIG. 3A

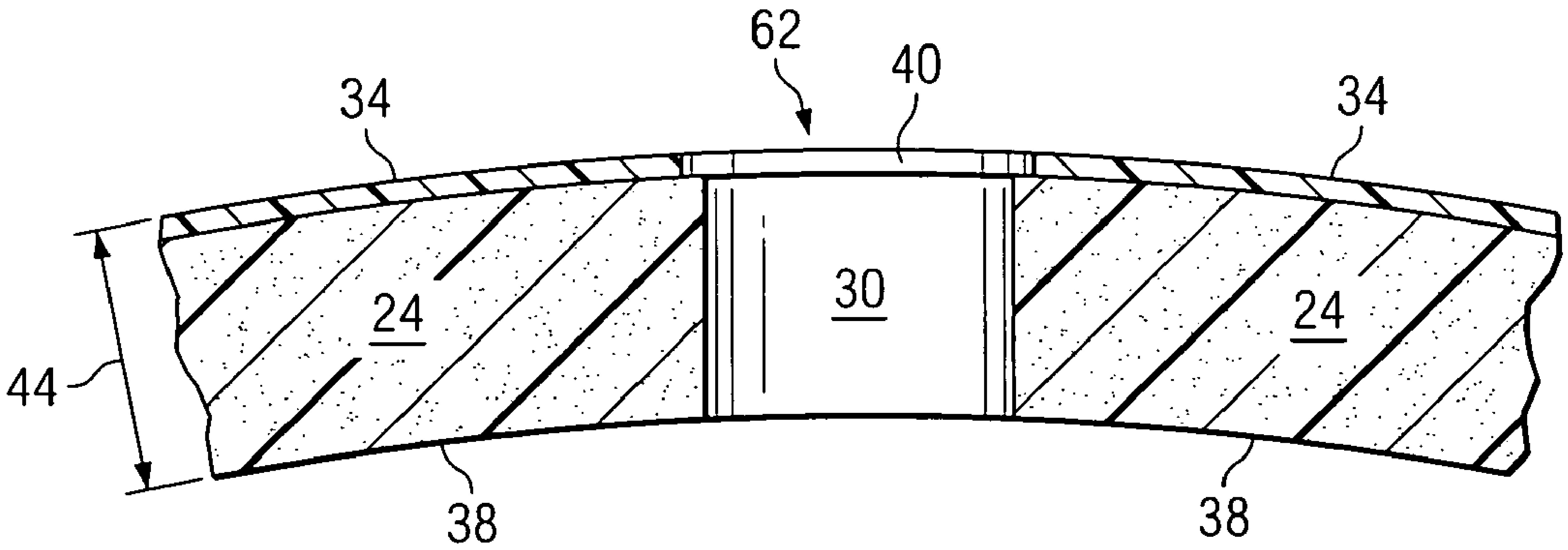

FIG. 3B

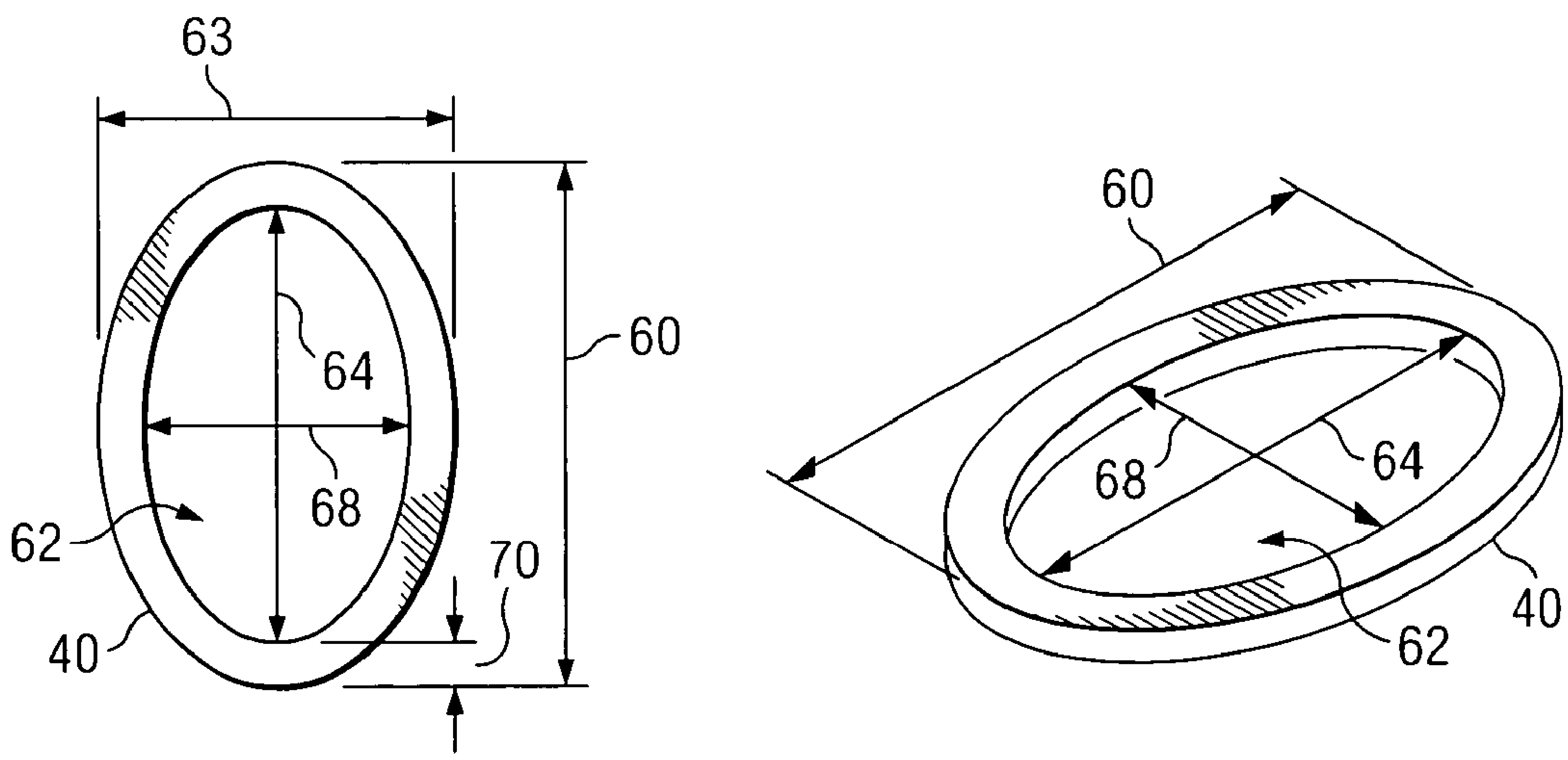

FIG. 4A

FIG. 4B

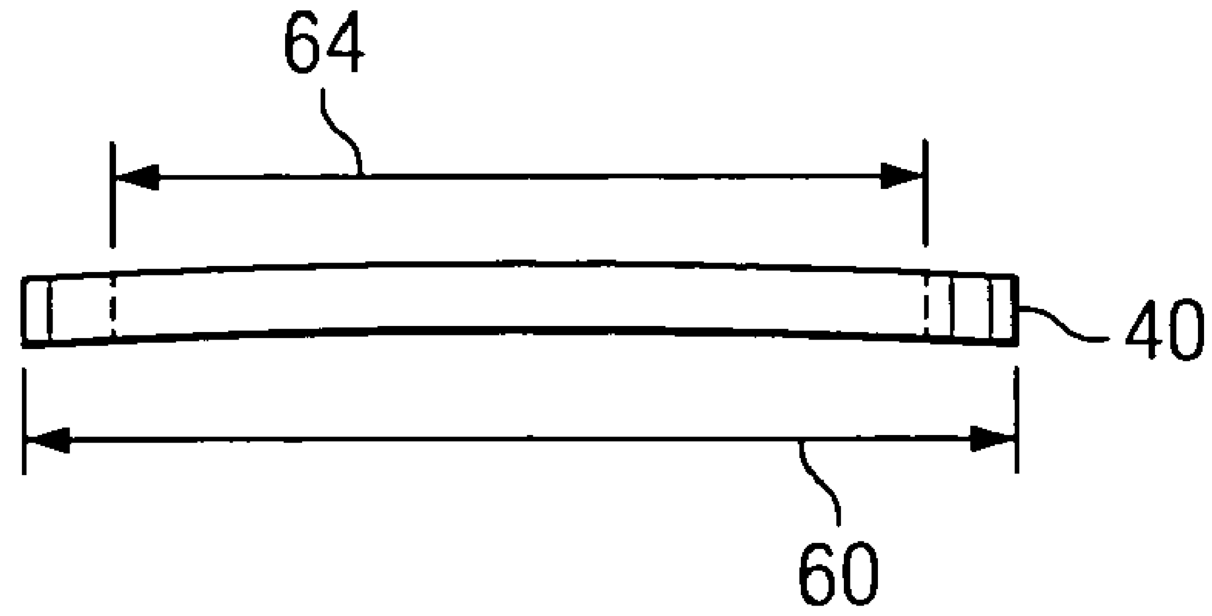

FIG. 4C

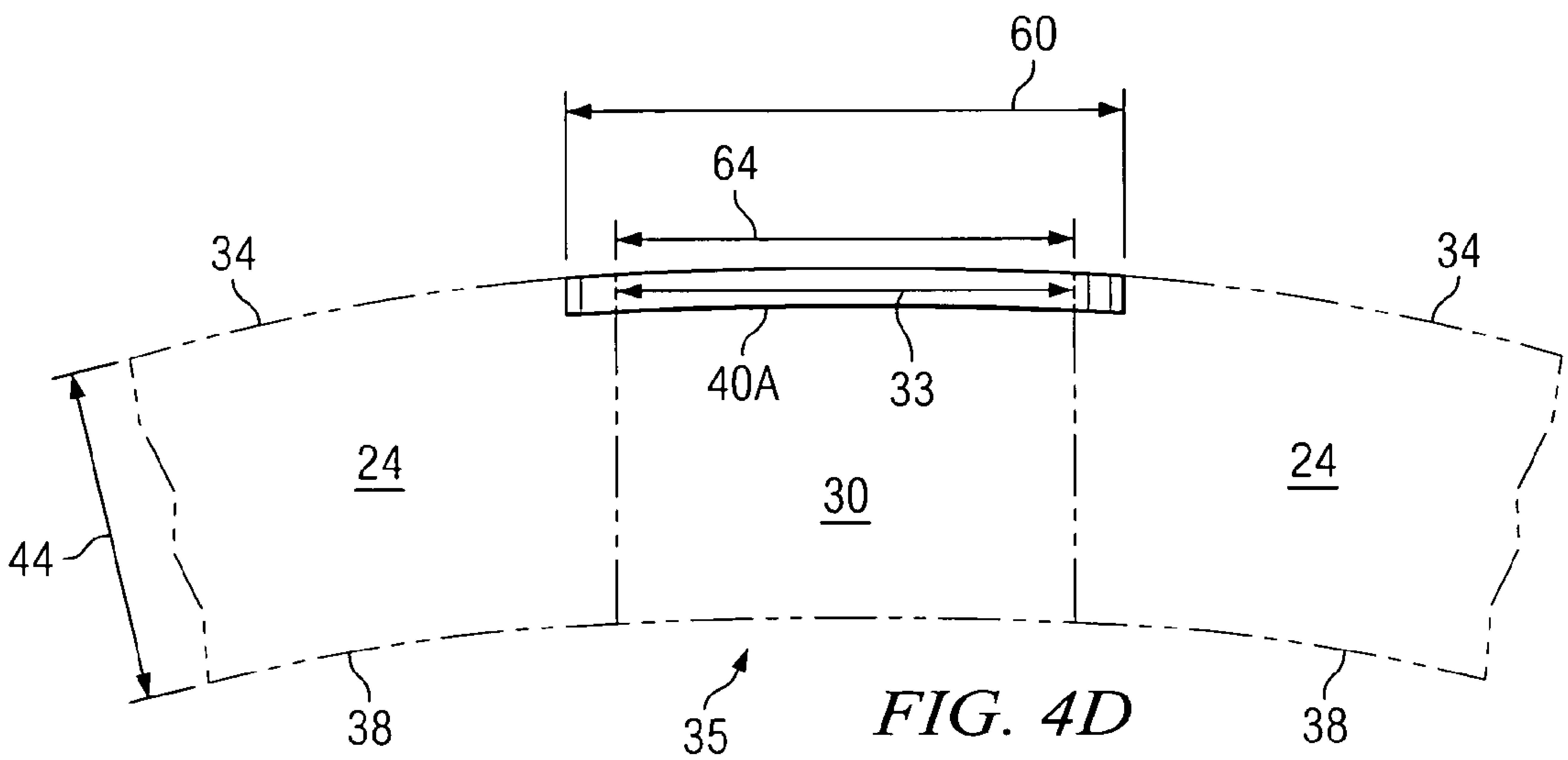

FIG. 4D

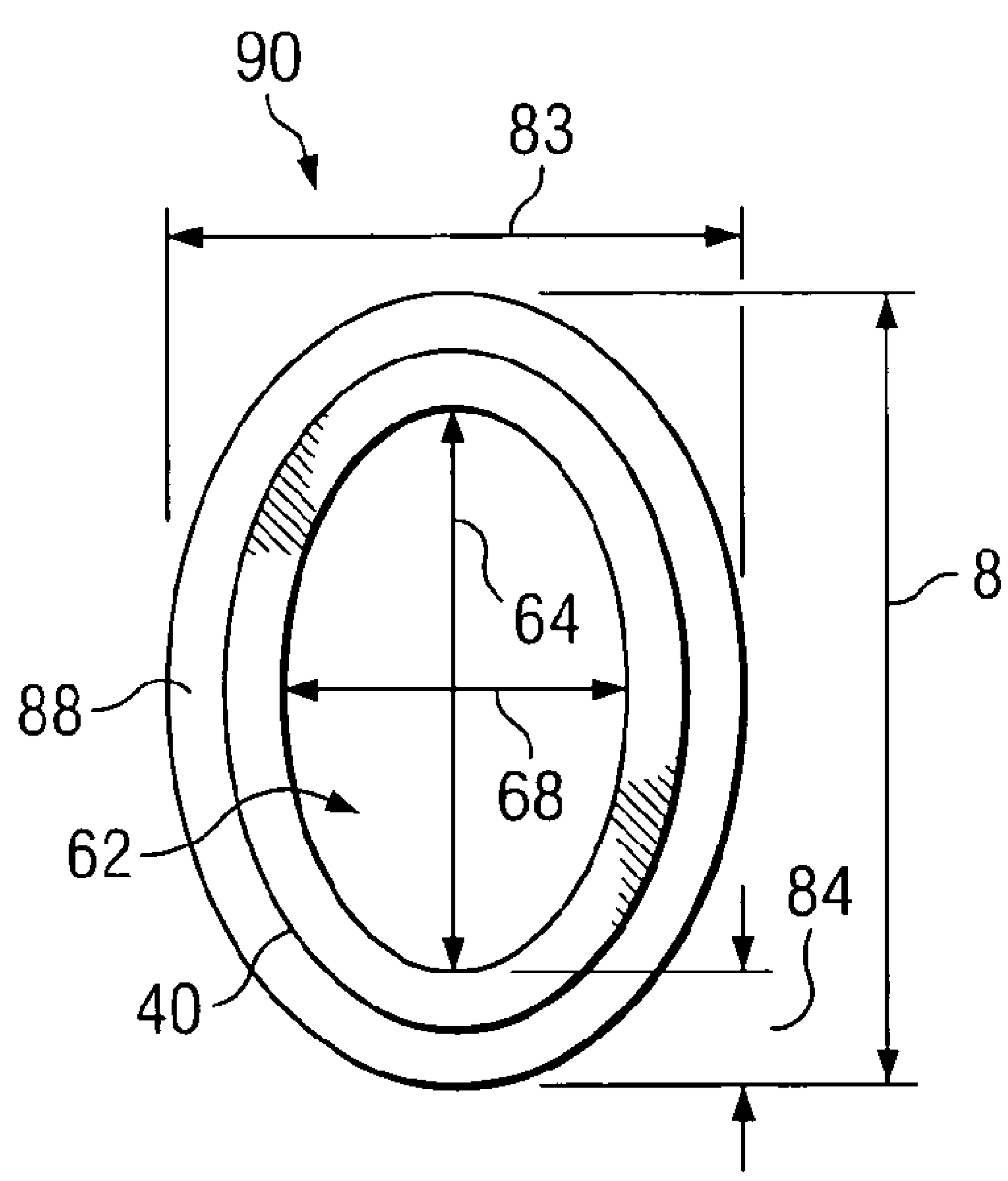

FIG. 5A

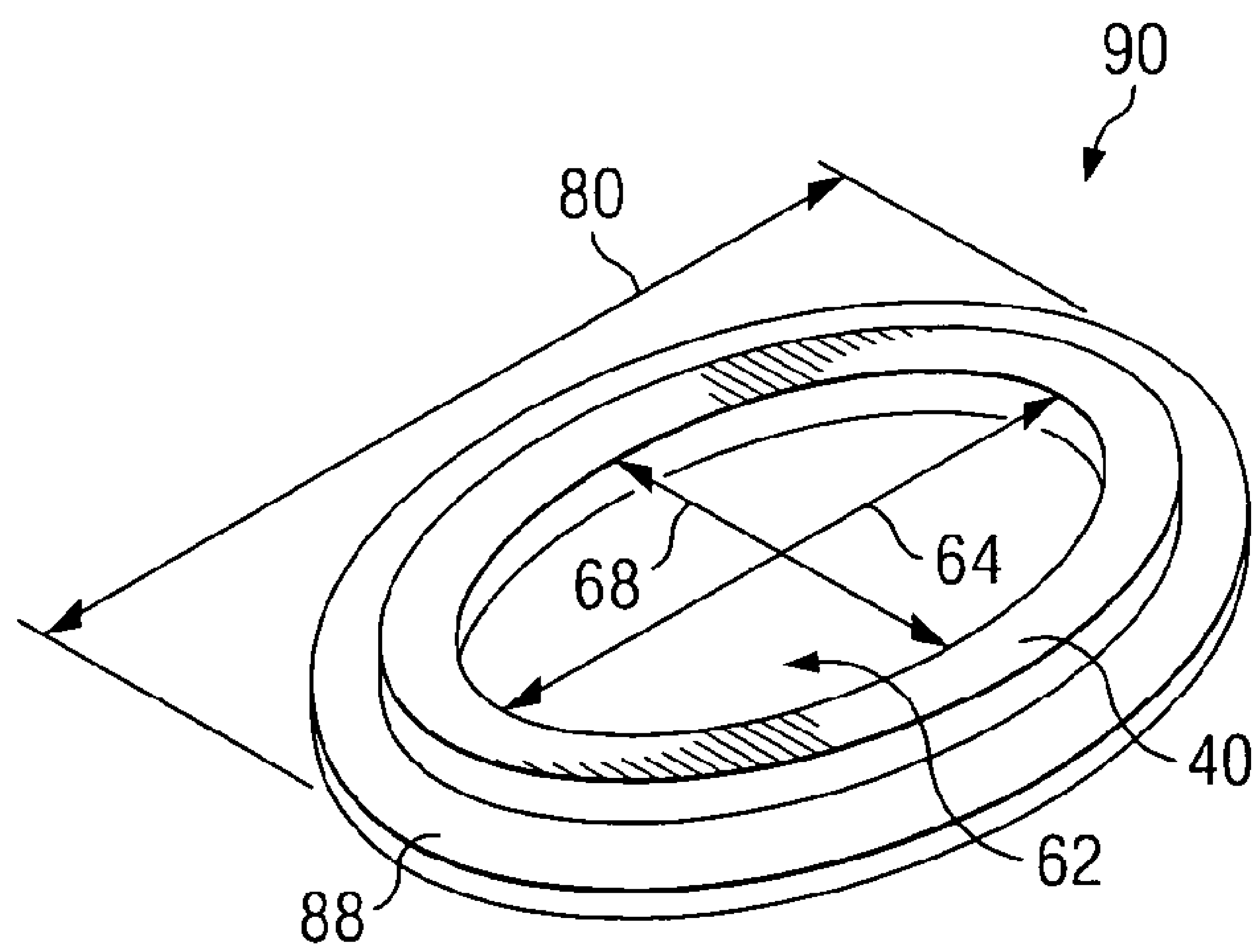

FIG. 5B

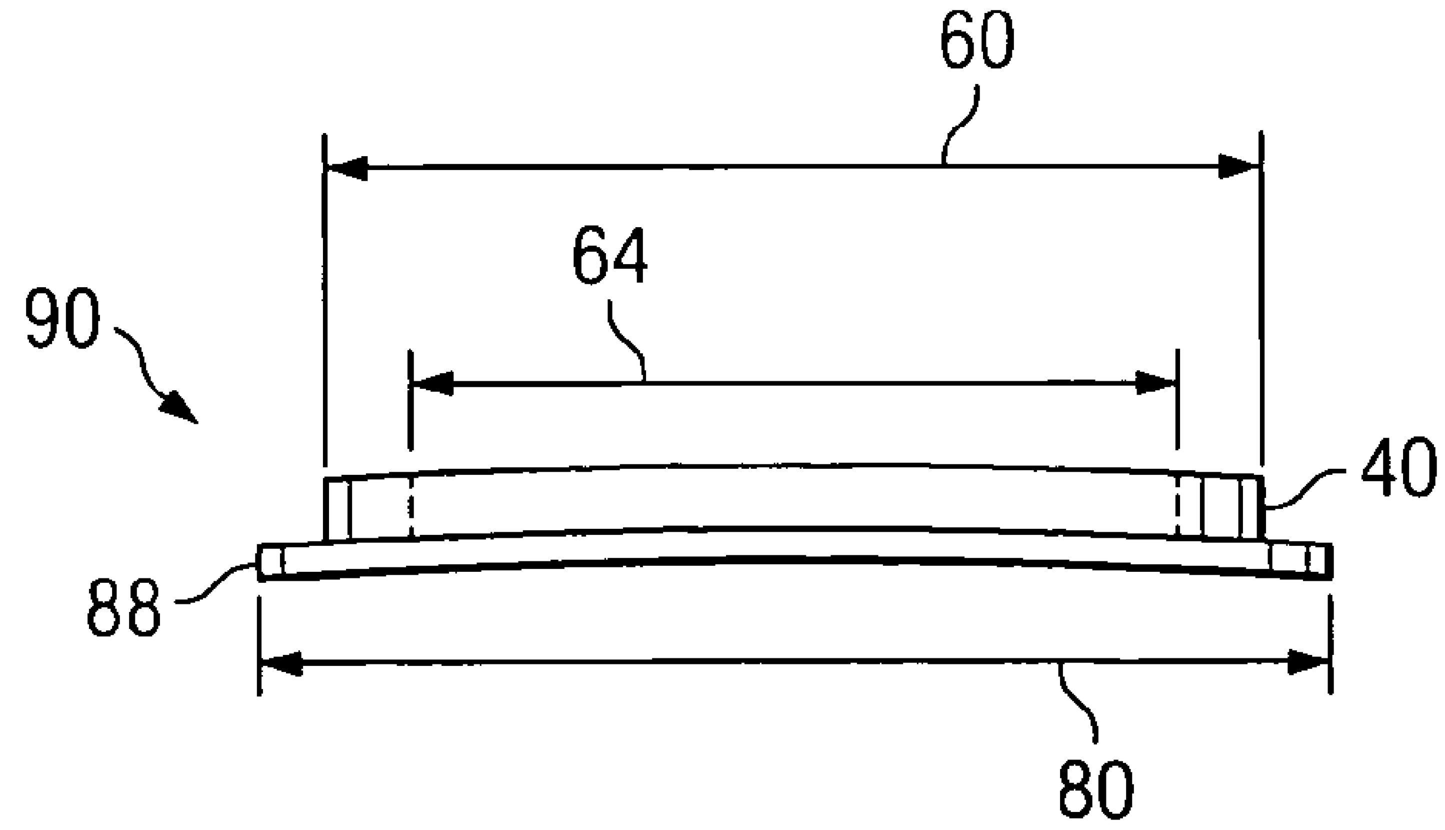

FIG. 5C

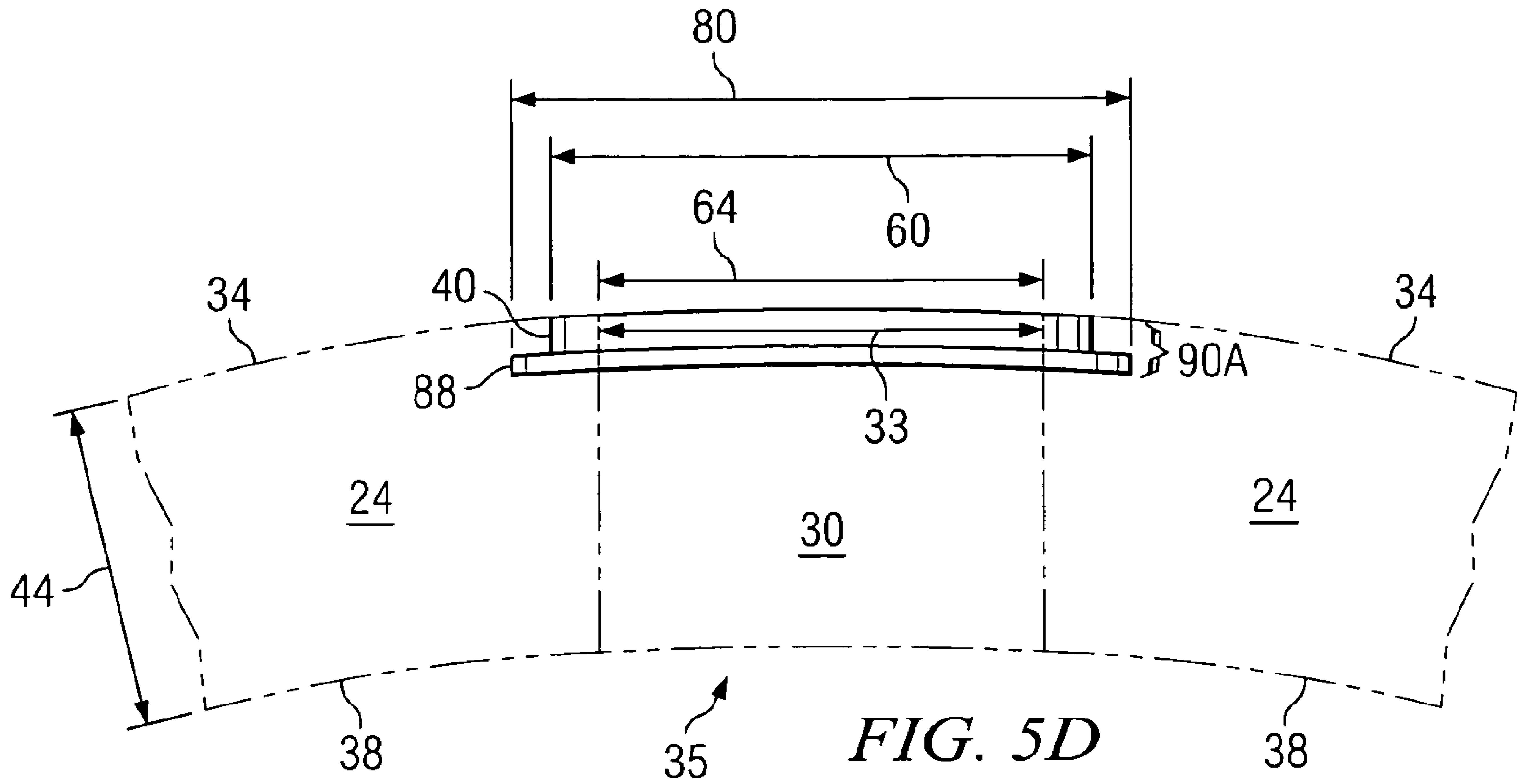

FIG. 5D

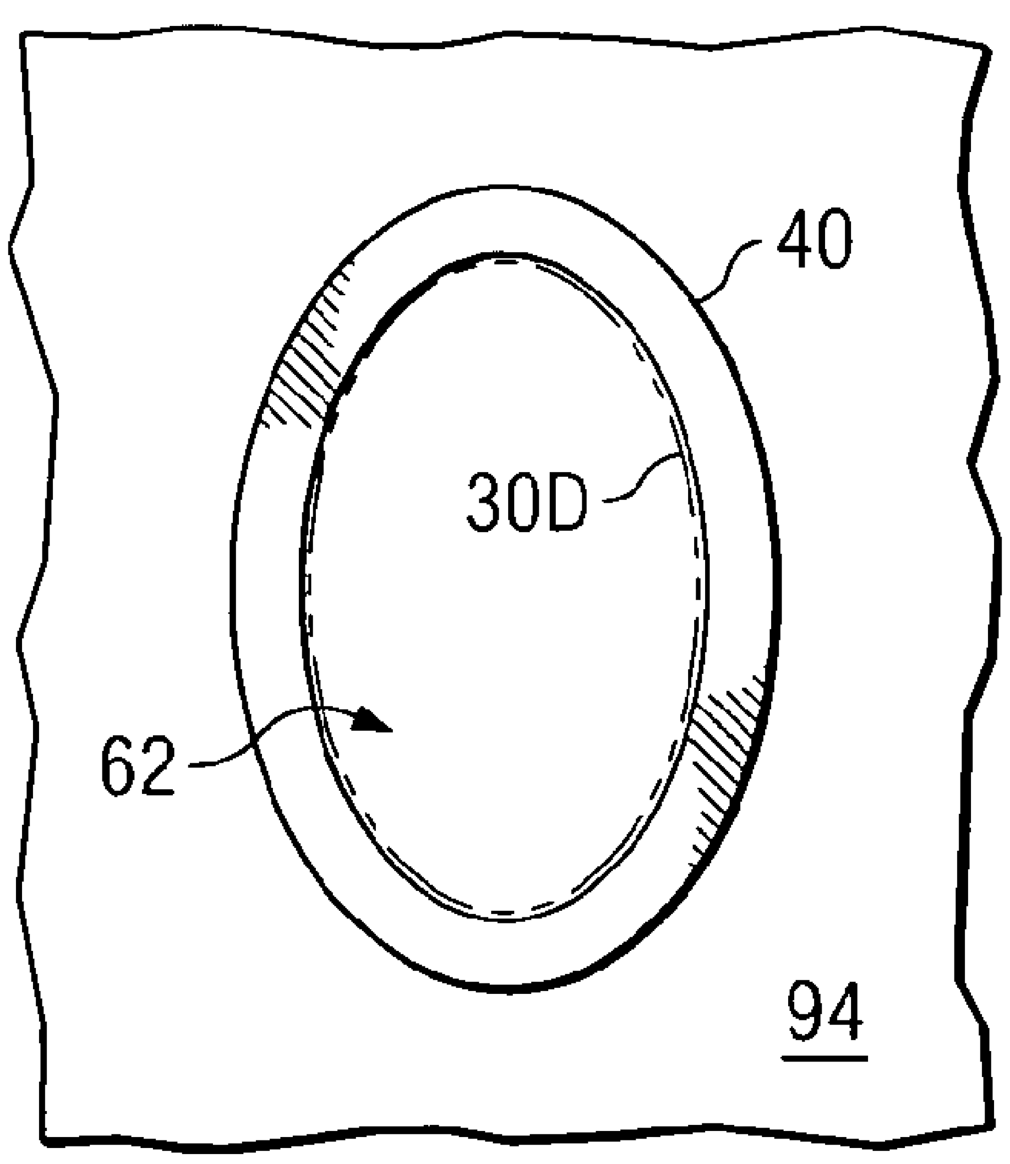

FIG. 6A

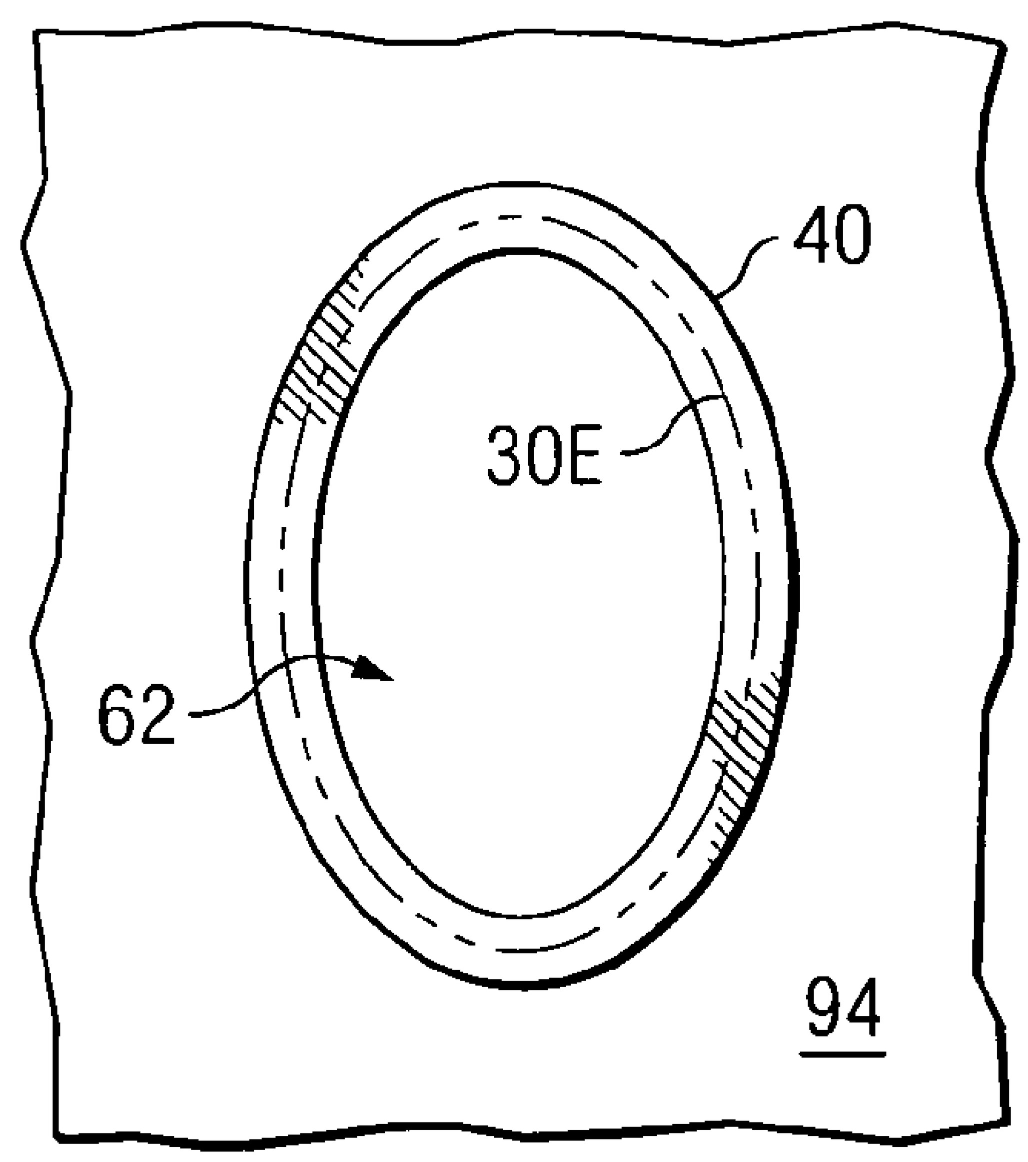

FIG. 6B

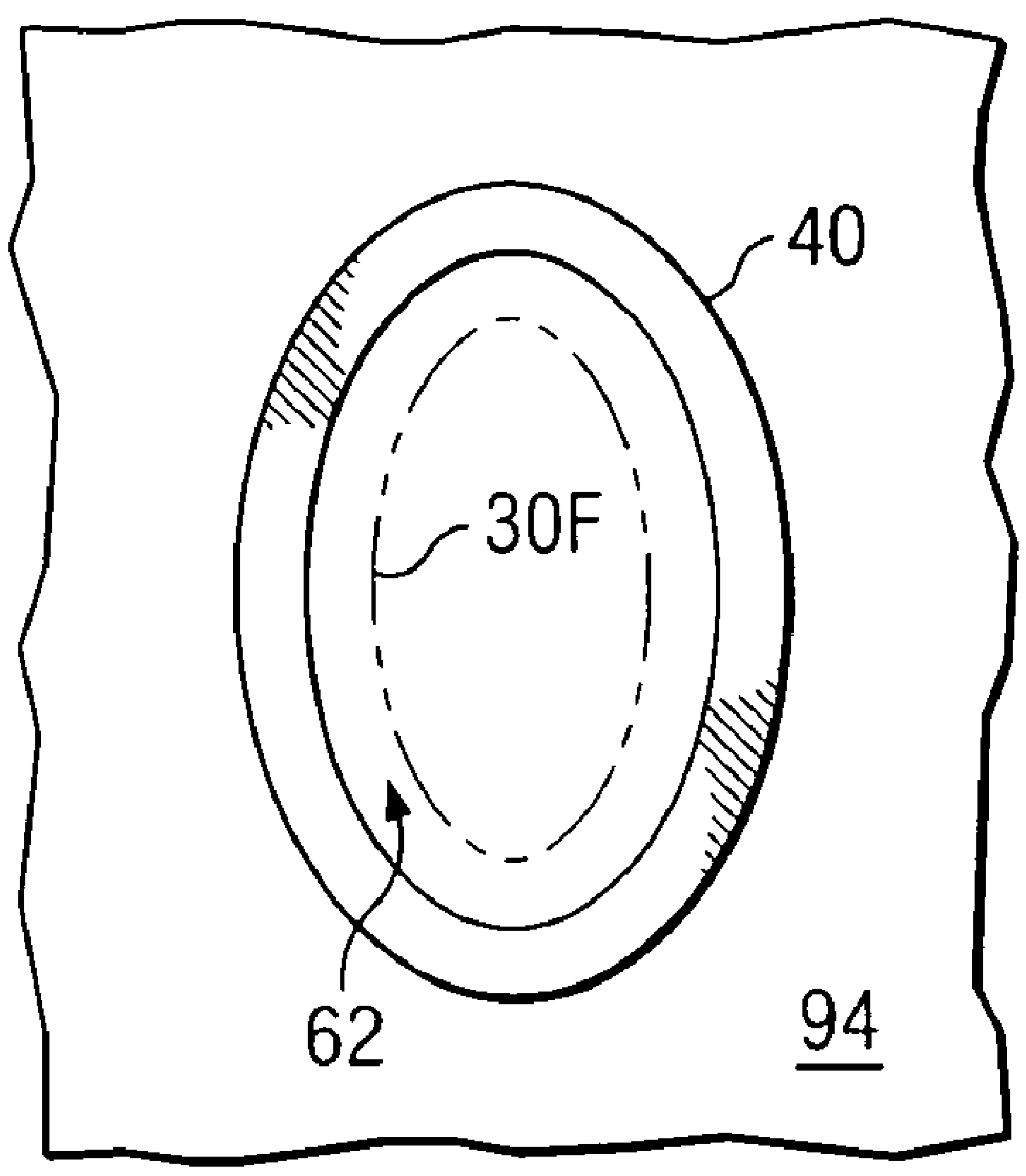

FIG. 6C

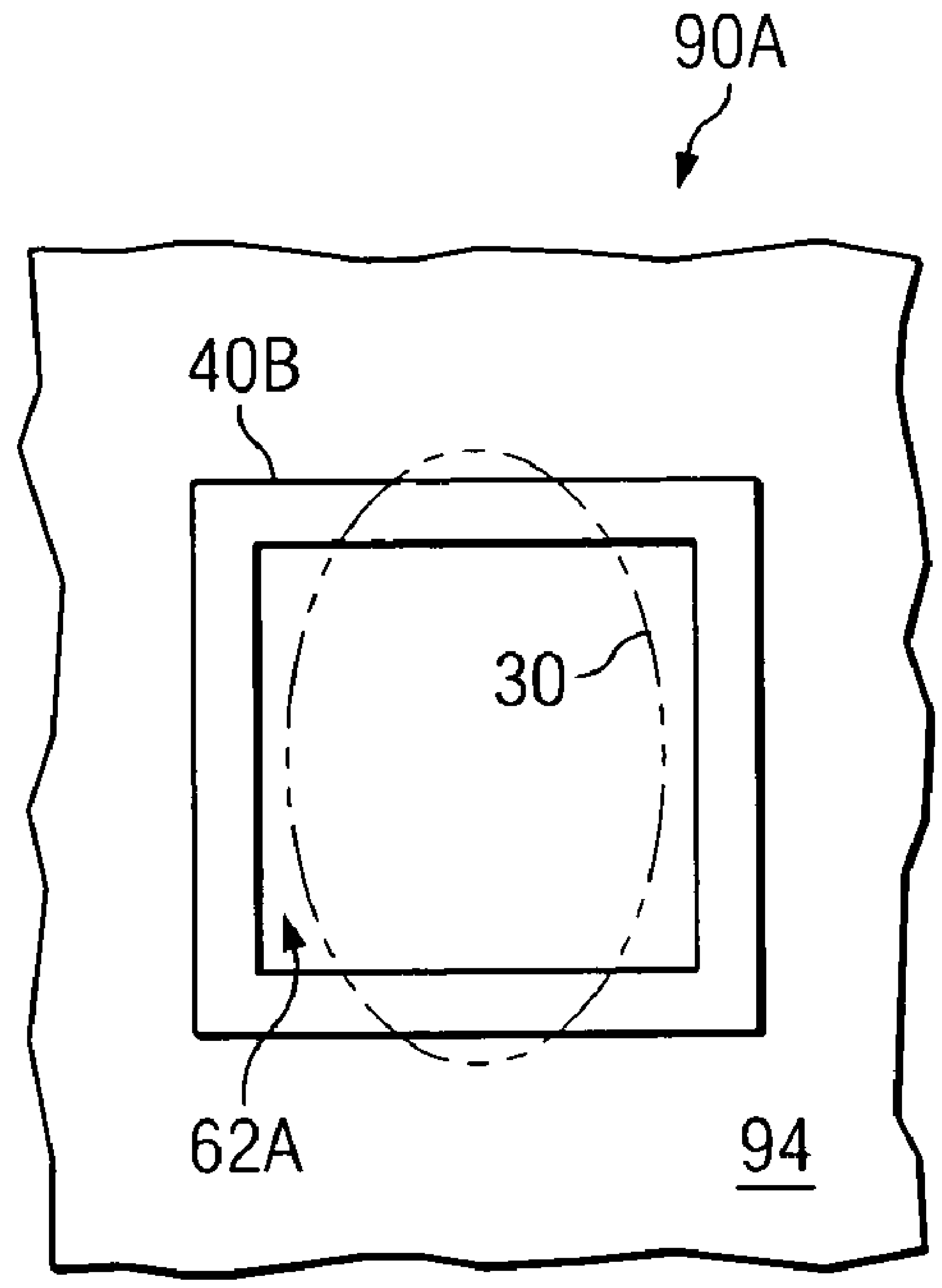

FIG. 6D

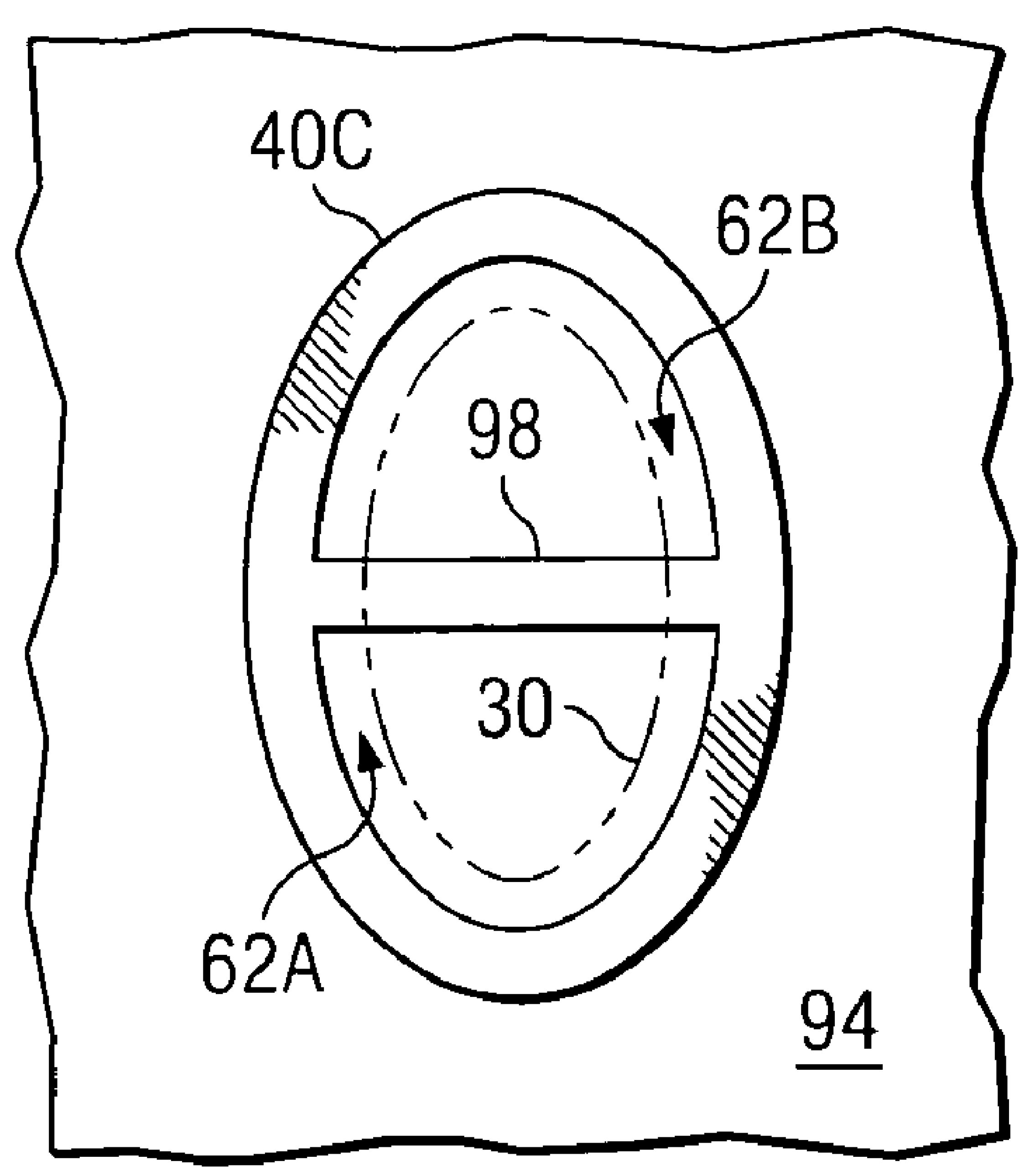

FIG. 6E

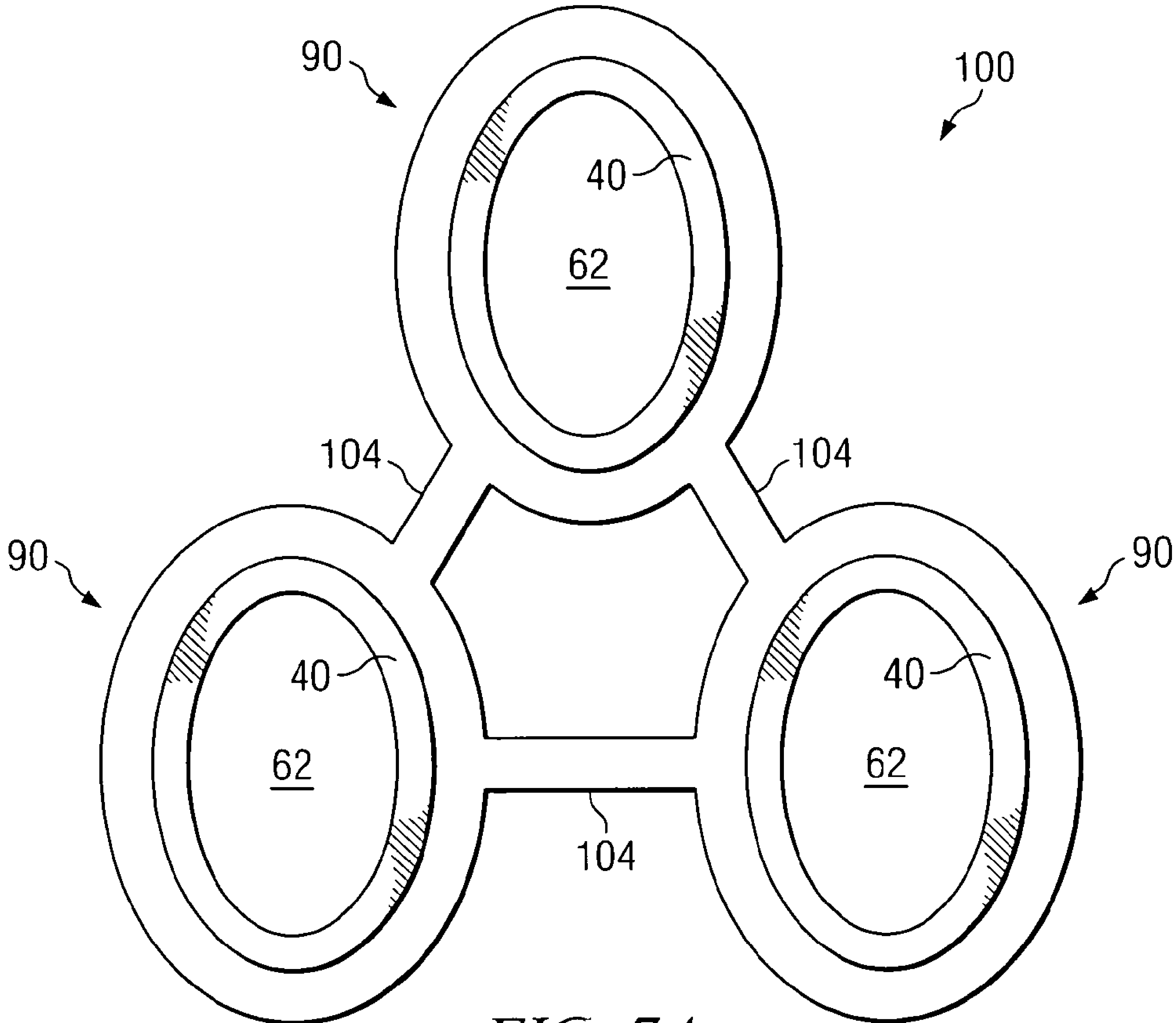
90
100
40
62
104
104
90
90
40
40
62
62
104

FIG. 7A

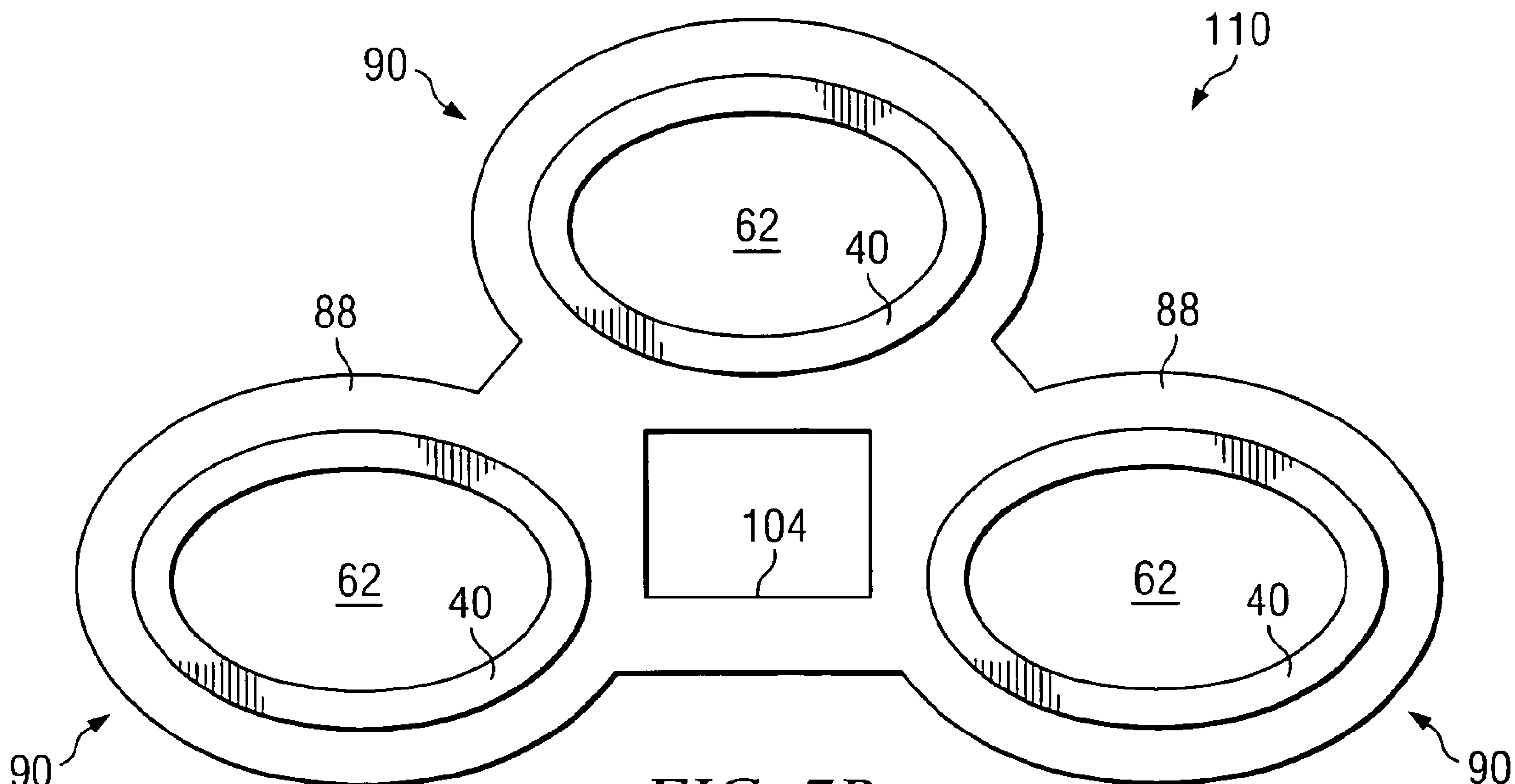
90
110
62
40
88
88
104
62
40
62
40
90
90

FIG. 7B

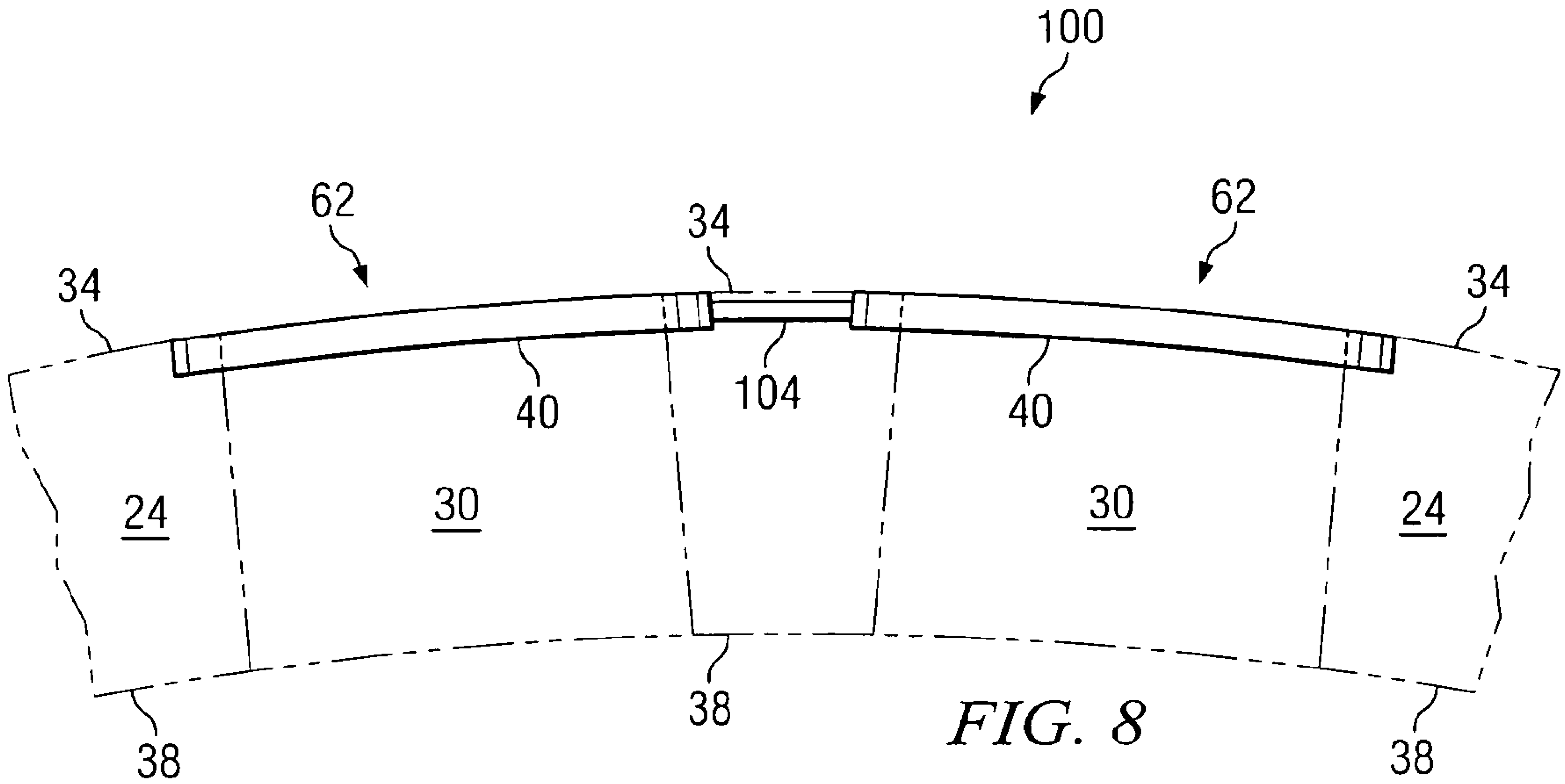
100
62
34
34
62
34
40
104
40
24
30
30
24
38
38
38

FIG. 8

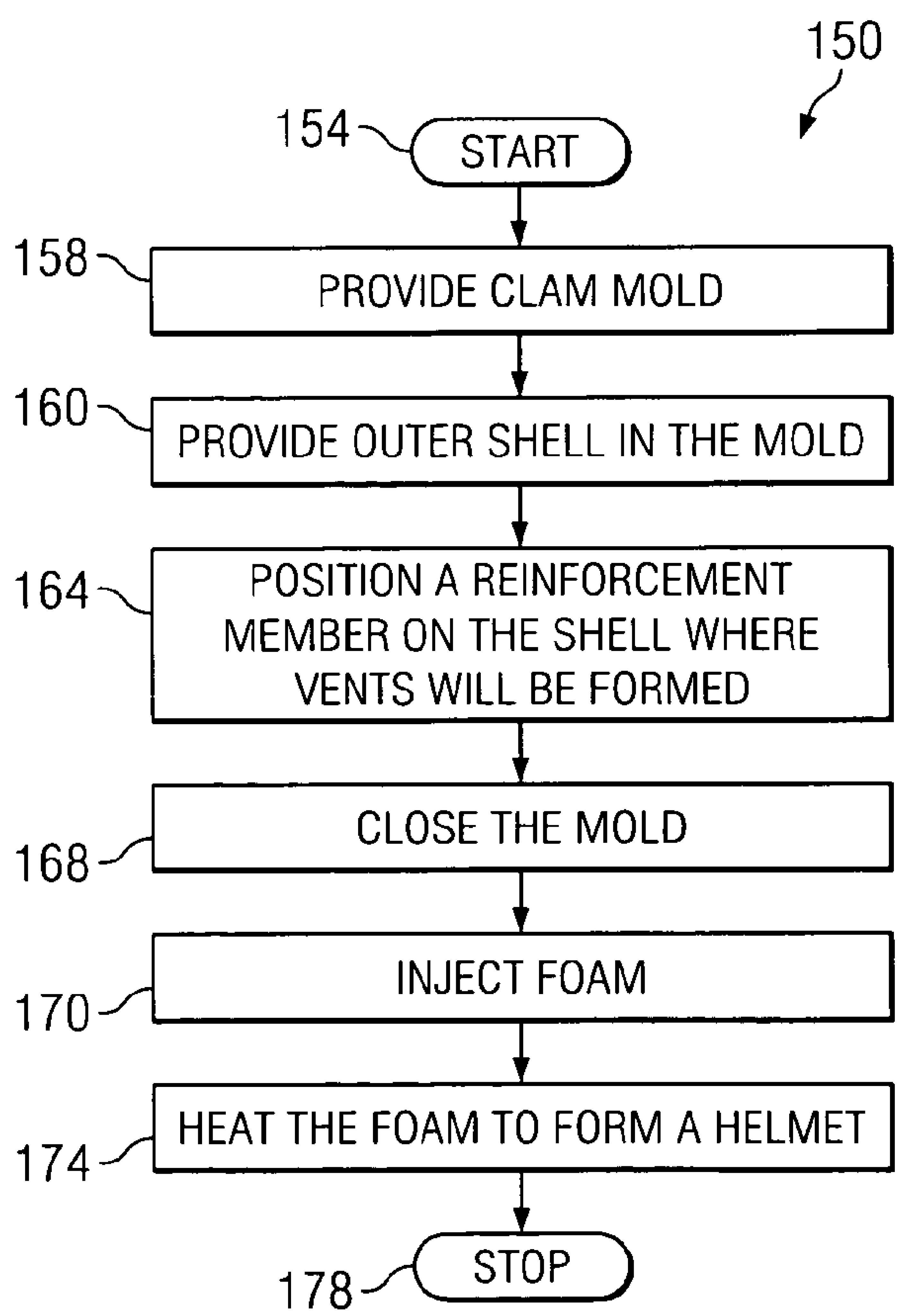
150
154
START
158
PROVIDE CLAM MOLD
160
PROVIDE OUTER SHELL IN THE MOLD
164
POSITION A REINFORCEMENT MEMBER ON THE SHELL WHERE VENTS WILL BE FORMED
168
CLOSE THE MOLD
170
INJECT FOAM
174
HEAT THE FOAM TO FORM A HELMET
178
STOP

FIG. 9

HELMET REINFORCEMENT SYSTEM

TECHNICAL FIELD OF THE INVENTION

This invention relates generally to protective gear and more particularly to a helmet reinforcement system.

BACKGROUND OF THE INVENTION

A physical impact to the head of a person may cause serious injury or death. To reduce the probability of such consequences, protective gear, such as a helmet, is often used in activities that are associated with an increased level of risk for a head injury. Examples of such activities include, but are not limited to, skiing, snowboarding, bicycling, rollerblading, rock climbing, skate boarding, and motorcycling.

A helmet may include one or more holes that allow air to reach the head of a wearer. Such a feature enhances comfort for the wearer and may also reduce the likelihood of heat-related injuries. However, these holes may also weaken the ability of a helmet to protect the head against certain types of physical impact.

SUMMARY OF THE INVENTION

According to one embodiment of the invention, a system for head protection is provided. The system includes a helmet body defining at least one hole. The system also includes at least one reinforcement member coupled to the helmet body. The reinforcement member defines an aperture that at least partially aligns with the hole of the helmet body.

Some embodiments of the invention provide numerous technical advantages. Other embodiments may realize some, none, or all of these advantages. For example, according to certain embodiments, a helmet is strengthened by reinforcing one or more ventilation holes or other types of holes in the helmet. In other embodiments of the invention, a helmet's vulnerability to a penetrating force applied to or near a ventilation or other hole in the helmet is reduced by strengthening at least a portion of the area that defines the hole.

Other advantages may be readily ascertainable by those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is now made to the following description taken in conjunction with the accompanying drawings, wherein like reference numbers represent like parts, in which:

FIG. **1** illustrates an example of an activity where a helmet that may benefit from the teachings of the present invention may be used;

FIG. **2**A is a perspective view of the helmet shown in FIG. **1**;

FIGS. **2**B through **2**D each shows a cross-sectional view of different embodiments of a hole defined by the helmet shown in FIG. **2**A;

FIG. **3**A is a perspective view of a reinforcement member defining an aperture positioned in an approximate alignment with the hole shown in FIG. **2**B;

FIG. **3**B is a side cross-sectional view of the hole and the reinforcement member shown in FIG. **3**A;

FIG. **4**A is a top view of a reinforcement member in accordance with one embodiment of the present invention;

FIG. **4**B is a perspective view of the reinforcement member shown in FIG. **4**A;

FIG. **4**C is a side view of the reinforcement member shown in FIG. **4**A;

FIG. **4**D is a side cross-sectional view of the reinforcement member shown in FIGS. **4**A through **4**C positioned in approximate alignment with the hole shown in FIG. **2**B;

FIG. **5**A is a top view of a reinforcement member in accordance with another embodiment of the present invention;

FIG. **5**B is a perspective view of the reinforcement member shown in FIG. **5**A;

FIG. **5**C is a side view of the reinforcement member shown in FIG. **5**A;

FIG. **5**D is a side cross-sectional view of the reinforcement member shown in FIGS. **5**A through **5**C positioned in approximate alignment with the hole shown in FIG. **2**B;

FIGS. **6**A through **6**E shows a top view of further embodiments of reinforcement members in accordance with the present invention positioned in approximate alignment with the hole shown in FIG. **2**B;

FIGS. **7**A and **7**B each shows a top view of a cluster of reinforcement members that may be used to reinforce a plurality of holes defined by the helmet shown in FIG. **2**A;

FIG. **8** is a side view of the cluster of reinforcement members positioned in approximate alignment with a plurality of holes shown in FIG. **2**A; and

FIG. **9** is a flowchart illustrating one embodiment of a method for reinforcing the holes defined by the helmet shown in FIG. **2**A.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS OF THE INVENTION

Embodiments of the invention are best understood by referring to FIGS. **1** through **9** of the drawings, like numerals being used for like and corresponding parts of the various drawings.

FIG. **1** is a schematic diagram illustrating one example of an environment **10** in which a helmet **20** according to one or more embodiments of the present invention may be used. As shown in FIG. **1**, environment **10** includes a snowboarder (user) **12** on a snowboard **14** wearing helmet **20** on a head **16** of user **12**. Helmet **20** is secured to head **16** of user **12** through the use of straps **18**. Although one example of helmet **20** is shown as a snowboard helmet in FIG. **1**, embodiments of the present invention may comprise or be used in conjunction with any type of protective headgear, such as a bicycle helmet, a motorcycle helmet, a hardhat, or the like.

Referring again to FIG. **1**, if head **16** of user **12** were to experience physical impact due to an accident, such as a fall or a collision, user **12** may be injured. Because the use of a protective headgear such as helmet **20** may reduce the severity of trauma to head **16** in case of an impact, the use of helmet **20** is strongly encouraged for many activities where the probability of injury to head **16** is relatively high. Although helmet **20** is designed primarily for the protection of head **16** of user **12**, helmet **20** may also be designed to increase the level of comfort for user **12**. To that end, helmet **20** may define one or more holes **30** for ventilation. Holes **30** may also be referred to as vents **30**.

Although holes **30** may increase the level of comfort for user **12**, the region of helmet **20** defining each hole **30** is structurally weaker than other regions that do not define a hole **30**. For example, where a penetrating object larger than hole **30** is forced into hole **30**, the area defining the hole **30** may more readily give way to the penetrating object than other regions of helmet **20**, which may allow the penetrating object to make direct impact with head **16** of user **12** and injure user **12**.

According to certain embodiments of the present invention, a helmet reinforcement system and method are provided. For example, according to certain embodiments, a helmet is strengthened by reinforcing an area of the helmet that defines a hole with a reinforcement member having an aperture that approximately aligns with the hole. In other embodiments of the invention, a helmet's vulnerability to a penetrating force applied at a hole defined by the helmet is reduced by strengthening a portion of the area that defines the hole. Additional details of such example embodiments of the invention are described below in greater detail in conjunction with FIGS. **2**A through **9**.

FIG. **2**A is a perspective view of helmet **20** shown in FIG. **1**. Helmet **20** comprises a body **24**, chin straps **18**, and holes **30** that are defined by body **24**. Body **24** may include single or multiple layers of the same or different material. For example, a layer formed from expanded polystyrene (EPS) and a layer of plastic overlying the layer of EPS may be body **24**. As shown in FIG. **2**A, holes **30** may have different shapes and sizes. Holes **30** may also have different cross-sectional side profiles, as described below in conjunction with FIGS. **2**B through **2**D. According to one embodiment of the invention, a plurality of reinforcement members **40** each defining an aperture are included in helmet **20** so that the aperture defined by each reinforcement member **40** approximately aligns with each corresponding hole **30** of helmet **20**. FIG. **2**A shows reinforcement member **40** using a phantom loop to indicate that reinforcement member **40** may be embedded into body **24** of helmet **20**. However, in certain embodiments, reinforcement member **40** may partially or wholly protrude out from the outer surface of helmet **20**. Furthermore, in certain embodiments reinforcement member **40** may be an open enclosure rather than a closed loop. In such embodiments, an area at least partially enclosed by reinforcement member **40** is referred to as an aperture.

In certain embodiments, reinforcement member **40** is made from a material that is tougher and less flexible than the material from which body **24** is formed. For example, where body **24** is formed from a layer of expanded polystyrene (EPS) and a plastic layer overlying the layer of EPS, reinforcement member **40** may be formed from polycarbonate plastic, acrylonitrile-butadiene-styrene (ABS), carbon fiber, fiberglass, stainless steel, platinum, titanium, or any other suitable material. However, in certain embodiments, reinforcement member **40** may formed from a material that is weaker than the material from which body **24** is formed. In certain embodiments, reinforcement member **40** may be positioned near the outer surface of helmet **20**. However, reinforcement member **40** may be positioned anywhere between the inner surface and the outer surface of helmet **20**, and anywhere on the outer surface of helmet **20**.

FIGS. **2**B through **2**D each illustrates a side cross-sectional view of different embodiments of holes **30** that may be included in helmet **20** shown in FIG. **2**A. FIGS. **2**B through **2**D are described jointly. Referring to FIG. **2**B, body **24** of helmet **20** comprises an outer surface **34** and an inner surface **38**. Inner surface **38** is the surface that faces head **16** of user **12**, and outer surface **34** is the surface that faces outwardly from head **16**. As shown in FIG. **2**B, body **24** defines a hole **30**A having an opening **33**A defined at outer surface **34** and an opening **35**A defined at inner surface **38**. As shown in FIG. **2**B, hole **30**A comprises a relatively constant diameter throughout the length of hole **30**A. Referring to FIG. **2**C, body **24** defines a hole **30**B having an opening **33**B defined at outer surface **34** and an opening **35**B at inner surface **38**. As shown in FIG. **2**C, hole **30**B has a larger opening **33**B at outer surface **34** than opening **35**B at inner surface **38**. Further, hole **30**B has a cross-sectional side profile that is non-symmetrical and increases in diameter as hole **30**B approaches outer surface **34**. Referring to FIG. **2**D, body **24** defines a hole **30**C having an opening **33**C defined at outer surface **34** and an opening **35**C defined at inner surface **38**. As shown in FIG. **2**D, opening **33**C is larger than opening **35**C, and hole **30**C has a cross-sectional side profile that is approximately symmetrical and increases in diameter as hole **30**C approaches outer surface **34**. Although FIGS. **2**C and **2**D show respective holes **33**B and **33**C increasing in diameter as they near outer surface **34**, in some embodiments, holes **33**B and **33**C may decrease in diameter as they near outer surface **34**. In some embodiments, holes **33**B and **33**C may have varying diameters throughout their respective lengths. Holes **30**A–**30**C respectively shown in FIGS. **2**B–**2**D are collectively referred to as holes **30**. Openings **33**A–**33**C defined at outer surface **34** respectively shown in FIGS. **2**B–**2**D are collectively referred to as openings **33**. Openings **35**A–**35**C defined at inner surface **38** respectively shown in FIGS. **2**B–**2**D are collectively referred to as openings **35**.

FIG. **3**A is a perspective view of one embodiment of reinforcement member **40**, where an aperture **62** defined by reinforcement member **40** is positioned in approximate alignment with hole **30**. FIG. **3**B is a side cross-sectional view of reinforcement member **40** and hole **30** shown in FIG. **3**A. FIGS. **3**A and **3**B are described jointly. Referring to FIG. **3**A, hole **30** is defined by body **24** having a thickness **44**. In certain embodiments, thickness **44** is in a range of approximately 1.0–2.0 inches. However, any suitable thickness **44** may be used. As shown in FIGS. **3**A and **3**B, in certain embodiments, reinforcement member **40** may be positioned in proximity to opening **33** defined at outer surface **34** of helmet **20**. However, reinforcement member **40** may be positioned anywhere along thickness **44** of body **24** shown in FIG. **3**B. In certain embodiments, positioning reinforcement member **40** near outer surface **34** is advantageous because such a position allows reinforcement member **40** to engage a penetrating object further away from head **16** of user **12**, which decreases the probability of injury. In certain embodiments, reinforcement member **40** is positioned within 0.5 inches from outer surface **34**. Although reinforcement member **40** is shown as a closed loop in FIGS. **3**A and **3**B, reinforcement member **40** may be in any suitable shape—open or closed—that allows reinforcement member **40** to resist an expansion of aperture **62** defined by reinforcement member **40**. Examples of suitable shapes for reinforcement member **40** include, but are not limited to, a rectangle, a triangle, a trapezoid, a hexagon, an octagon, a circle, and an oval.

FIG. **4**A is a top view of one embodiment of reinforcement member **40** shown in FIG. **3**A. FIG. **4**B is a perspective view of reinforcement member **40** shown in FIG. **4**A. FIG. **4**C is a side view of reinforcement member **40** shown in FIG. **4**A. FIG. **4**D is a side cross-sectional view of one embodiment of reinforcement member **40** shown in FIGS. **4**A through **4**C, where aperture **62** defined by reinforcement member **40** is positioned in approximate alignment with hole **30** shown in FIG. **2**B. FIGS. **4**A through **4**D are described jointly. As shown in FIGS. **4**A–**4**C, reinforcement member **40** comprises major and minor diameters **60** and **63**, a width **70**, and defines aperture **62** having a plurality of diameters **64** and **68**. In some embodiments, a diameter refers to the length of straight line segment passing through the center of a figure, such as reinforcement member **40**, and terminating at a periphery of the figure. Referring to FIG. **4**D, reinforcement member **40** may comprise a side profile that allows reinforcement member **40** to conform to the contour of outer surface **34** of helmet **20**. For example, as shown in FIG. **4**D, a reinforcement member **40**A comprises a curved side profile to conform to the curved contour of outer surface **34**.

In certain embodiments, the size and shape of aperture **62** may be approximately equal to the size and shape of a portion of hole **30** where reinforcement member **40** is positioned. For example, where reinforcement member is position near outer surface **34**, aperture **62** may have an approximately same size and shape as opening **33** defined at outer surface **34**. In certain embodiments, width **70** of reinforcement member **40** is such that reinforcement member **40** can be supported by the area of body **24** that defines hole **30**. Any suitable width **70** may be selected based on the protection requirements of helmet **20**.

FIG. **5**A is a top view of one embodiment of a reinforcement member **90** that may be used to strengthen helmet **20** shown in FIG. **2**A. FIG. **5**B is a perspective view of reinforcement member **90** shown in FIG. **5**A. FIG. **5**C is a side view of reinforcement member **90** shown in FIG. **5**A. FIG. **5**D is a side cross-sectional view of one embodiment of reinforcement member **90** shown in FIGS. **5**A through **5**C, where aperture **62** is positioned in alignment with hole **30** shown in FIG. **2**B. FIGS. **5**A through **5**D are described jointly. As shown in FIG. **5**A, in one embodiment, reinforcement member **90** includes reinforcement member **40** supported by a flange **88**. Reinforcement member **90** defines aperture **62** that has major and minor diameters **64** and **68**. Reinforcement member **90** has major and minor diameters **80** and **83**, and a width **84**. Diameter **80** and width **84** are greater than diameter **60** and width **70** (shown in FIG. **4**A). This is advantageous in some embodiments because flange **88** strengthens reinforcement member **40** and also provides a larger contact area between reinforcement member **90** and body **24** of helmet **20**. Thus, force that urges reinforcement member **90** against body **24** of helmet **20** is more widely distributed on body **24**, which allows reinforcement member **90** to bear a greater load that may be experienced in an impact with a penetrating object.

In certain embodiments, diameter **64** is in a range of approximately 1.5–2.5 inches, diameter **68** is in a range of approximately 0.5–1.0 inches, diameter **80** is in a range of approximately 1.75–3.00 inches, and diameter **83** is in a range of approximately 0.75–1.5 inches. Width **84** is in a range of approximately 0.2–0.5 inches. The ranges of diameters **64** and **68** may also apply to aperture **62** shown in FIGS. **4**A–**4**D. Although certain ranges are described above as examples, any suitable diameters **64**, **68**, **80**, **83**, and any suitable width **84** may be used depending on the material used to form reinforcement members **40** and **90**, the material used to form body **24**, thickness **44**, and the protection requirements of helmet **20**. Referring to FIG. **5**D, reinforcement member **90** may comprise a side profile that allows reinforcement member **90** to conform to the contour of outer surface **34** of helmet **20**. For example, as shown in FIG. **5**D, reinforcement member **90** comprises a curved side profile to conform to the curved contour of outer surface **34**.

Although FIGS. **4**D and **5**D show aperture **62** defined by reinforcement member **40** as having the same size and shape as opening **33** and directly aligned with opening **33**, aperture **62** may be smaller or larger than hole **30**, and may not be exactly aligned with opening **33**. In certain embodiments, aperture **62** has a different size and shape than hole **30** and includes at least one dimension, such as diameter **64** or **68**, that is small enough to engage a conical penetrating object before the penetrating object reaches inner opening **35** of hole **30**.

FIGS. **6**A through **6**E each shows a top view of a particular embodiment of reinforcement member **40** shown in FIG. **3**A, where aperture **62** is positioned in approximate alignment with hole **30** shown in FIG. **2**B. FIGS. **6**A through **6**E are described jointly. FIGS. **6**A through **6**E show hole **30** using a phantom loop. As shown in FIG. **6**A, in certain embodiments, the size and shape of aperture **62** is approximately the same as the size and shape of a hole **30**D. As shown in FIG. **6**B, in certain embodiments, aperture **62** defined by reinforcement member **40** may be smaller than a hole **30**E, provided that outer diameter **60** (shown in FIG. **4**A) and thickness (shown in FIG. **4**A) are sufficient enough to engage at least a portion of the area of body **24** that defines hole **30** to sufficiently resist force applied on reinforcement member **40** against body **24** of helmet **20**.

As shown in FIG. **6**C, in certain embodiments, aperture **62** defined by reinforcement member **40** may be larger than a hole **30**F, provided that at least one dimension of aperture **62**, such as a diameter, is small enough to engage a penetrator before any portion of the penetrator breaks the curved plane defined by inner surface **38** of helmet **20**. Referring to FIG. **6**D, in certain embodiments, a reinforcement member **40**B having a different shape than hole **30** may be used to reinforce hole **30**. Reinforcement member **40**B defines a rectangular aperture **62**A. Aperture **62**A includes at least one dimension, such as a diameter, that is small enough to engage a penetrator before any portion of the penetrator breaks a curved plane defined by inner surface **38** of helmet **20**. Although the shape of reinforcement member **40**B is shown as a rectangle in FIG. **6**D, any suitable shape may be used. Referring to FIG. **6**E, in certain embodiments, a reinforcement member **40**C may include a cross-member **98** that cuts across aperture **62**, thus defining apertures **62**A and **62**B. More than one cross-member **98** may be used to provide additional support for reinforcement member **40**C. This is advantageous in certain embodiments because using cross-member **98** improves reinforcement member's **40**C ability to maintain diameter **68** (shown in FIG. **4**A) when a penetrator is forced into reinforcement member **40**C.

FIG. **7**A is a top view of a cluster **100** of reinforcement members **90** that may be used to reinforce a particular set of holes **30** defined by helmet **20** shown in FIG. **2**A. FIG. **7**B is a top view of a cluster **110** of reinforcement members **90** that may be used to reinforce another set of holes **30** defined by helmet **20** shown in FIG. **2**A. Referring to FIG. **7**A, cluster **100** comprises a plurality of reinforcement members **90** that are joined by extensions **104**. Each reinforcement member **90** defines an aperture **62**. Extensions **104** have a combination of length and orientation that positions each aperture **62** in approximate alignment with corresponding hole **30** of helmet **20**. As shown in FIG. **7**B, cluster **110** comprises a plurality of reinforcement members **90**, where at least some of reinforcement members **90** are joined directly at flange **88** rather than through extension **104**. The use of such clusters **100** and/or **110** is advantageous in some embodiments of the invention because the number of separate parts that need to be managed during the manufacture of helmet **20** is reduced.

FIG. **8** is a side view of cluster **100**, where apertures **62** of reinforcement members **90** are positioned in approximate alignment with respectively corresponding holes **30** shown in FIG. **2**A. The extension **104** illustrated in FIG. **8** has a particular length and orientation that approximately aligns aperture **62** with respective hole **30**. In certain embodiments, cluster **100** may comprise a side profile that allows cluster **100** to conform to the contour of outer surface **34** of helmet **20**. For example, as shown in FIG. **8**, cluster **100** comprises a curved side profile to conform to the curved contour of outer surface **34**.

FIG. **9** is a flowchart illustrating one embodiment of a method **150** for reinforcing holes **30** defined by helmet **20** shown in FIG. **2**A. Method **150** starts at step **154**. At step **158**, a clam shell mold having a reverse shape of a helmet to be made is provided. The clam shell mold provided at step **158** defines a plurality of structures that designate the location of holes **30** of helmet **20**. At step **160**, an outer shell may be laid in the clam shell mold of step **158**. The outer shell may be formed from a sheet of plastic and may be used to display color, design, and logo for the helmet. The outer shell may also provide a layer of protection against dirt and weather for the helmet. The outer shell includes holes so that the structures of the clam shell mold may fit through the holes of the outer shell. At step **164**, a reinforcement member, such as reinforcement member **90**, is positioned around the structure of the clam shell mold that identifies the position of hole **30**. At step **168**, the mold is closed. At step **170**, a material is injected into the clam shell mold. In certain embodiments, EPS may be injected into the clam shell mold at step **170**; however, any suitable material may be used. At step **174**, the material and the outer shell are heated to form body **24** of helmet **20**. Method **150** stops at step **178** (although other steps may be performed to add additional features to the helmet, such as a retention system). Method **150** described above is one of many ways that different embodiments of reinforcement members **40**/**90** may be coupled to helmet **20**.

Although some embodiments of the present invention have been described in detail, it should be understood that various changes, substitutions, and alterations can be made hereto without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A system for head protection, comprising:

a helmet body, the helmet body comprising a shock-absorbent layer and an outer shell overlying the shock-absorbent layer, the shock-absorbent layer defining at least one hole; and

at least one reinforcement member coupled to the shock-absorbent layer, wherein the reinforcement member:

defines an aperture that at least partially aligns with the hole of the shock-absorbent layer;

has a thickness substantially less than the thickness of the shock-absorbent layer defining the hole; and

is substantially the same size as the hole.

2. The system of claim **1**, wherein the aperture has the same size and the same shape as the hole.

3. The system of claim **1**, wherein the aperture and the hole are substantially aligned.

4. The system of claim **1**, wherein the hole and the aperture have at least one approximately identical diameter.

5. The system of claim **1**, wherein the at least one hole and the at least one reinforcement member each comprises a substantially oval shape.

6. The system of claim **1**, wherein the shock-absorbent layer comprises an outer surface and an inner surface, the hole extending from the outer surface to the inner surface, and wherein the reinforcement member is positioned no more than 0.5 inches from the outer surface.

7. The system of claim **1**, wherein the shock-absorbent layer comprises an outer surface and an inner surface, and wherein the reinforcement member is positioned closer to the outer surface than to the inner surface.

8. The system of claim **1**, wherein the shock-absorbent layer comprises an outer surface and the hole comprises an opening defined at the outer surface, and wherein the aperture has an approximately same size and an approximately same shape as the opening.

9. The system of claim **1**, wherein the shock-absorbent layer comprises an outer surface, and the member is positioned approximately at the outer surface.

10. The system of claim **1**, wherein the shock-absorbent layer is formed from one or more first materials and the reinforcement member is formed from a second material that is tougher than the one or more first materials.

11. The system of claim **1**, wherein at least a portion of the region of the shock-absorbent layer defining the hole is formed from expanded polystyrene and the reinforcement member is formed from a polycarbonate plastic.

12. The system of claim **1**, wherein at least a portion of the region of the shock-absorbent layer defining the hole is formed from expanded polystyrene and the reinforcement member is formed from carbon fiber.

13. The system of claim **1**, wherein the shell defines an opening corresponding to the hole, wherein the reinforcement member is embedded into the shell.

14. The system of claim **1**, wherein the reinforcement member is disposed between the shock-absorbent layer and the shell.

15. The system of claim **1**, wherein:

a first reinforcement member is associated with a first hole and a second reinforcement member is associated with a second hole; and

at least the first and second reinforcement members are joined directly or by an extension to form a cluster.

16. A system for head protection, comprising:

a helmet body, the helmet body comprising a shock-absorbent layer and an outer shell overlying the shock-absorbent layer, the shock-absorbent-layer having an outer surface and defining at least one hole having an opening at the outer surface, the opening having a size and a shape; and

at least one reinforcement member positioned in proximity of the outer surface of the shock-absorbent layer, the reinforcement member defining an aperture that at least partially aligns with the opening, the aperture having an approximately same size and shape as the opening, the reinforcement member being substantially the same size as the hole.

17. The system of claim **16**, wherein the opening and the aperture are substantially aligned.

18. The system of claim **16**, wherein the reinforcement member is positioned no more than 0.5 inches from the outer surface.

19. The system of claim **16**, wherein the shock-absorbent layer comprises an inner surface, and wherein the reinforcement member is positioned closer to the outer surface than to the inner surface.

20. The system of claim **16**, wherein the shock-absorbent layer is formed from one or more first materials and the reinforcement member is formed from a second material that is tougher than the one or more first materials.

21. The system of claim **16**, wherein at least a portion of the region of the shock-absorbent layer defining the hole is formed from expanded polystyrene and the reinforcement member is formed from a polycarbonate plastic.

22. The system of claim **16**, wherein at least a portion of the region of the shock-absorbent layer defining the hole is formed from expanded polystyrene and the reinforcement member is formed from carbon fiber.

23. The system of claim **16**, wherein the shell defines an opening corresponding to the hole, wherein the reinforcement member is embedded into the shell.

24. The system of claim **16**, wherein the reinforcement member is disposed between the shock-absorbent layer and the shell.

25. The system of claim **16**, wherein the opening and the at least one reinforcement member each comprises a substantially oval shape.

26. The system of claim **16**, wherein:

a first reinforcement member is associated with a first hole and a second reinforcement member is associated with a second hole; and

at least the first and second reinforcement members are joined directly or by an extension to form a cluster.

27. A system for head protection, comprising:

a first means for absorbing shock defining at least one hole;

a second means for absorbing shock overlying the first means; and

at least one means for reinforcement of the first means for absorbing shock, the means for reinforcement:

defining an aperture that at least partially aligns with the at least one hole of the first means for absorbing shock;

having a thickness substantially less than the thickness of the first means for absorbing shock; and

being substantially the same size as the hole.

28. The system of claim **27**, wherein:

a first means for reinforcement is associated with a first hole and a second means for reinforcement is associated with a second hole; and

at least the first and second means for reinforcement are joined directly or by an extension to form a cluster.

29. A system for head protection, comprising:

a helmet body, the helmet body comprising a shock-absorbent layer and an outer shell overlying the shock-absorbent layer, the shock-absorbent layer:

formed from a first material;

having an outer surface and an inner surface; and

defining a plurality of holes, each hole extending from the outer surface to the inner surface and comprising an opening having a size and a shape at the outer surface; and

a plurality of reinforcement members formed from a second material that is tougher and less flexible than the first material and positioned in proximity of the outer surface of the shock-absorbent layer, each reinforcement member:

having a one-to-one correspondence with a particular hole;

defining an aperture having an approximately same size and shape as the opening of the particular hole, wherein the aperture of each reinforcement member substantially aligns with the opening of the particular hole; and

being substantially the same size as the hole.

30. The system of claim **29**, wherein at least one reinforcement member is joined directly or by an extension to at least one other reinforcement member to form a cluster.

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